A BUSINESS PLAN FOR THE INTRODUCTION OF THE TRANSFLUX FLUID HEATER IN THE FOOD PROCESSING INDUSTRY IN NEW ZEALAND

A project report submitted in partial fulfilment of the requirements for the Degree of Master of Engineering in the University of Canterbury, Christchurch, New Zealand

By

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DISCLAIMER

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ACKNOWLEDGEMENTS

"Give Honour to whom Honour is due"

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EXECUTIVE SUMMARY

Market Background

The heater market in New Zealand makes use of various sources of energy such as coal, gas, oil and electricity.

Most large companies have central boilers providing steam or hot water. This steam or hot water is then fed through pipes to the various points of use. A lot of heat is lost in these pipes, as most of them are not well insulated.

Food processing industries are moving away from the operation of large centralised boilers. Point of use systems are now in use as the savings that could be obtained both in energy and running costs are quite substantial. These point of use systems make it possible for boilers to be operated only when they are needed. It also cuts down on the number of personnel involved in maintaining the boiler and the heat losses in the pipes.

Transflux Heater

The Transflux fluid heater is a revolutionary product developed in the University of Canterbury. It operates on the principle of transformer/induction/resistive heating principles. It has numerous advantages over conventional boilers as it heats a continuous stream of fluid with no need for a fluid tank. The heater is small in size, and has even heating properties. The manufacturing cost is less than the cost of conventional boilers. The Transflux heater is well suited for use as part of point of use systems. The heater is made from low cost materials and the capital cost is significantly less than most conventional boilers in use.

Company Structure

A company called Transflux Holdings Ltd was formed to patent the product. This is a non-trading company that holds the intellectual property rights. The shareholders of this company comprises Southpower, the University of Canterbury, Ross Walker and Dr Pat Bodger. Several potential applications have been identified for the use of the

Transflux heater. At present, the food processing, health care and commercial industries are being studied.

A company called Transflux Developments Ltd has been set up to manufacture and market this product. This company is presently 100% owned by Southpower. The units are presently being manufactured in the workshop of the Electrical and Electronic Engineering department. The main objectives at present are to build awareness for the product and obtain as many test sites as possible.

Target Markets

In the food processing industry, five markets have been identified. These are brewing, dairy, ham and sausage, canned foods and mushroom dehydration industries. The most attractive are the brewing and dairy industries. The ham and canned foods industries require the development of a steam unit which will be done during the next two years.

Marketing Programme

A marketing program has been developed which will enable the company to enter the five markets. A substantial amount of promotion will be carried out and this will be in the form of public relations campaigns, sales promotions and personal selling. Distribution will start in the Christchurch area and will move to the rest of the South Island by 1996. The North Island market will be entered in 1997. Test sites will be established during the first two years. Pricing of the product will be such that costs will be recovered while gaining useful information about the products operations. After the roll out in the South Island, the product will be priced at its perceived value. The selling strategy will be based on the customer focus technique where customer satisfaction creates profit.

Financial Summary

The entire marketing program will be monitored closely and the proforma financial statements will help in controlling the program. Table 1 and Fig 1 show a summary of the financials for Transflux Developments.

	1993	1994	1995	1996	1997	1998	1999
Revenue	0	46000	136000	300500	486250	674000	1158750
Gross Margin	0	22802	69380	186573	303179	425101	741895
Expenses	90000	183400	198400	231100	276300	318800	356600
Tax	0	0	0	0	0	0	31129
Profit	(90000)	(160598)	(129020)	(44527)	26879	106301	354166
Owners Equity	250000	325000	500000	575000	625000	625000	625000
ROI				-25.65%	10.17%	27.68%	49.25%
Current Ratio				6.42	6.47	7.42	8.47

Table 1 Summary of financials

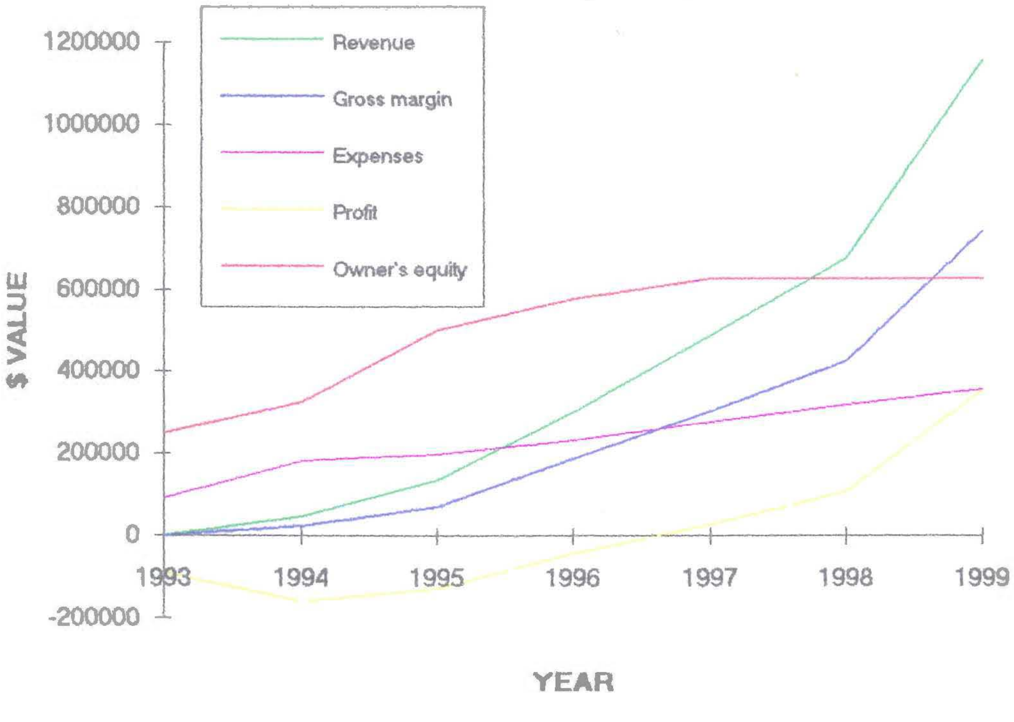

Fig 1 Graph of financial summary

The marketing program will need $375,000 to sustain it. Equity financing will be sought and the company will have other shareholders together with Southpower.

The company will start making a profit in 1997. A Dividend of around $50,000 is expected to be paid out in 1999.

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CHAPTER 1 - THE HEATER MARKET

1.1 Energy sources in New Zealand

There are various sources of energy in New Zealand. The energy market consists of two forms of energy, primary energy obtained directly from the environment (eg coal, natural gas, oil), and secondary energy, which is obtained by converting primary energy to another form (gas to electricity) suitable for consumption.

Inter-fuel competition exists in varying degrees in all segments of the non-transport consumer energy market. In the domestic and commercial markets, the main competition is between electricity and gas for water heating, space heating and cooking loads. In the industrial markets, competition exists primarily between natural gas, electricity, coal and oil for various heat raising applications. These four main energy sources are used in conjunction with boilers.

1.1.1 Coal

New Zealand has enough coal reserves to last it well into the next century. Coal can be found in different regions of the country. The energy and ash content vary considerably from region to region.

The use of coal in boilers has its drawbacks. It contains sulphur which burns in the combustion process, giving off sulphur oxide which can be corrosive and cause ill health. In coal boilers, a chimney has to be constructed for the emission of the fumes to the atmosphere at a height above what is considered harmful and which gives easy dispersion and dilution.

1.1.2 Oil

New Zealand does not produce enough oil to meet existing demand. Some of the oil that is produced is of high quality and can obtain a better price overseas and is therefore exported. As a consequence, there is a continuing need for imports. Most of the world's oil reserves are located in the politically volatile Middle East region.

Due to political differences between countries, the long term price stability of oil is low and oil prices are very vulnerable to events such as the recent Gulf war. There is a finite oil resource and it is very likely that if alternate forms of energy are not found in the near future, the reserves of oil will be depleted.

There are various grades of oil used in the boiler industry. Both light and heavy fuel oil require pre-heating before combustion. The thick consistency of heavy fuel oil makes it more difficult to handle. Burning of oil produces sulphur dioxide which can be corrosive and cause ill health.

1.1.3 Natural gas

New Zealand has reserves of gas which comes from two main fields in the North Island. These are the Maui gas fields which produce 84% of New Zealand's gas resource and the Kapuni gas fields which account for 11%. The future of natural gas supplies in New Zealand is the subject of constant speculation although the Natural Gas Corporation insists that all the speculation is of a pessimistic nature.

Maui gas prices are lower than most new sources can profitably be produced, and as Maui reserves diminish, demand for gas will lead to higher prices and thus reduce any competitive advantage that presently exists.

Gas is a very competitive form of energy as it is very cheap. The relative simplicity of the pricing methods as compared to other forms of energy sources adds to its competitive advantages. This enables end-users to evaluate competitive bids with much less time, effort and expertise.

1.1.4 Electricity

There is an extensive nationwide electricity distribution network comprising nearly 138,000 kilometres of power lines and 133,000 distribution substations.

Power companies purchase 95% of their electricity from a single state owned source, the Electricity Corporation of New Zealand (ECNZ). Transmission is through Transpower which is a subsidiary of ECNZ. 80% of the power generated by ECNZ is from hydro dams and the rest is from thermal and geothermal stations.

With the deregulation of the power industry, the supply dominance of ECNZ may be considerably reduced and electricity in the coming years may be more competitive as customers would have the opportunity of purchasing power from whatever supplier offers the best deal.

The price of electricity, unfortunately, gets too much attention. Focus should, however, be directed on the value obtained from its use and the service or process performed.

The cleanliness of electricity and the fact that New Zealand has one of the cheapest electricity charges, makes electricity a very competitive option as fuel for heating purposes.

1.2 Government energy policy

After the elections of November 6 1993, the government announced that it has no energy policy. This was the result of speculations that ECNZ was going to be privatised. A government policy is expected to be released sometime in 1994.

The energy sector contributes over 80% of man-made carbon dioxide emissions in New Zealand. In 1990 the National Government announced a planning target of reducing total carbon dioxide emissions to 80% of their 1990 level by the year 2000. The means by which this will be achieved is yet to be made clear.

1.3 Boilers

The term "boiler" applies to a device for generating:

- Hot water for heating purposes or hot water supply
- Steam for process heating, heating purposes or power generation

Boilers are designed to transmit heat from an external source (electrical heat energy or fuel combustion) to a fluid contained within the boiler itself. If the unit is other than water or steam, the unit is classified as a vaporiser or a thermal fluid heater.

Heat Transfer

Flow of boiler heat from the fluid into the water or steam may occur in three ways:

- Radiation
- Convection
- Conduction

One or another or a combination of these three modes enter into all the varied phases of heat transfer.

Whatever its character, the fluid in the boiler must be safely contained. The steam or hot water must be delivered in the desired condition with respect to pressure, temperature, quality and at the desired flow rate. It is essential that the heat generated should be delivered with minimum losses.

The heat output rate (steam and hot water generated per hour) depends on the following factors:

- Amount of energy used
- Extent of combustion of the furnace fuel
- Type and area of heating surface
- Circulation of steam or water
- Fluid inlet temperature

In most boilers, it is usually necessary to provide chemical feedwater treatment to remove the impurities which are most commonly a build-up or a concentration of soluble salts. These are removed by blowdown either at scheduled intervals or continuously.

1.4 Boiler Types

<u>Thermal Fluid Heaters</u>

A thermal fluid heater is a closed vessel in which a heat transfer medium other than water is heated without vaporisation. Many fluids other than air and water can be used as a heat transfer medium for:

- Heat transfer in industrial applications
- Energy transfer for power generation

Because of the special chemical or physical properties that these fluids possess, it is often advantageous to use them instead of air, water or steam. Water is by far the best heat carrier. It has high specific heat, fair thermal conductivity and a relatively low viscosity. Water, however, has several distinct disadvantages:

- It freezes below 0°C
- The vapour pressure of water at temperatures above 205°C is sufficient to require expensive equipment
- No latent heat of condensation is available above 375°C.
- Substantial amounts of energy in the form of latent heat must be discarded when steam is used as a driving medium

Thermal fluids may be considered for use in a thermal system if any of the following conditions apply:

- The heat transfer medium is to remain fluid at temperatures approaching, or below 0°C
- The temperature required is above 375°C
- Heat transfer is desired without a chemical reaction
- High temperature heat transfer is desired without the high pressure of steam

Hot Water Boilers

Hot water boilers may be classified by any of the following categories:

- Capacity - Instantaneous or storage type
- Method of heat application
- End use - domestic hot water (all residential types), service hot water (commercial and industrial types)
- Type of control - automatic or manual (non-automatic) operation
- Lining material - stainless steel, copper etc.

Most hot water boilers are of the storage type. The water is heated and then held at the required temperature until needed. This method of obtaining hot water is very common in service hot water where huge quantities of hot water are usually required.

An instantaneous hot water heater supplies hot water for immediate use, requiring no storage vessel. It is designed to have sufficient capacity to meet maximum temperature demands at peak draw. If the peak demand exceeds its capacity, cooler water will be delivered as there is no reserve. When properly sized, it will usually provide a continuous supply of hot water. The advantages are:

- Space requirements are small
- No necessity to wait for a storage tank to heat up

The disadvantages are:

- Close temperature control cannot be maintained with fluctuating demand.
- Power input requirements

When hot water demands are intermittent, storage systems are quite economical as several hours may elapse between peak load periods. During these hours, the heater will heat the water at a relatively low rate to a predetermined temperature.

Steam Boilers

Steam generators in common use are either fuel-fired or electric (mainly electrode boilers). Steam generators provide saturated steam or superheated steam. Fuel fired steam generators are equipped with burners that could be diesel, extra-heavy fuel oil or natural gas. Electric generators are usually completely packaged.

Electrode Boilers

This type of heater generates its heat through the resistance of water. Pure distilled water is a poor conductor of electricity, but the quantity of impurities normally found in fresh water is responsible for making the conductivity such that it can be used as a resistance.

Electrode boilers have electrodes immersed in water and conductivity begins when the electricity is applied to the electrodes. The resistance of the water causes heat to be generated directly in the water without the use of any other mode of heat transfer.

Electrode boilers can only operate with an AC supply of electricity. If DC is passed through water, it becomes decomposed into its elemental gases.

Electrode boilers are available for either steam raising or for the production of hot water. However, they are seldom used for the latter.

Heat Pumps

Heat pumps extract energy from a source at low temperature, too low for it to be useful for heating purposes directly, and upgrades it to a higher temperature. Two to five times as much energy is provided for heating as is consumed in driving the heat pump. This makes the device attractive as a means of reducing energy consumption. The uses of heat pumps range from room heating, through space conditioning, to process heating.

The heat pump is a more complicated device than conventional boilers and its capital cost is correspondingly higher.

1.5 Prices

Boiler prices vary considerably depending on the manufacturer and distributor. Table 1.1 lists some prices of various boilers.

Boiler type	Rating (kW)	Price ($)
Storage cylinder	3	500-1000
Instant hot water systems	8-10	500-800
Thermal fluid heater	82	27,000
Electrode boiler	50	10,000
	100	15,000
	600	25,000
Fuel fired steam boilers	105	25,000
fuel fired hot water boiler	75	8,000
Electric hot water boiler	150	11,000

Table 1.1 Different types of boilers and their prices

The price for a storage hot water cylinder depends on the size of the cylinder, the size of the manufacturer and the materials used in the manufacturing. Most of these units are sold through distributors and retailers.

Instant hot water systems are mostly domestic and these units are sold through retail outlets.

Larger boilers have varying prices depending on the type of fuel used as the energy source. Specific pricing is difficult to compare on such boilers as there are a lot of alternatives and/or additional items which may be required by clients to suit specific applications. However, most boilers are sold as packaged units and hence the prices indicated are that of boiler and basic accessories.

The price of a thermal fluid heater is inclusive of add on items such as a thermal oil pump set, and natural gas or LPG fired burners. There are very few thermal heaters of ratings below fifty kilowatts.

Electrode boilers for producing steam also vary in prices. These usually are complete packaged units. The control unit of electrode boilers is mainly pressure dependent.

Fuel fired steam units are generally more expensive. Many safety devices have to be present in the system because of the explosive nature of high pressure steam. Steam is highly corrosive on boiler equipment, due to the deposition of nitrates and carbonates during the phase change, water softening equipment is usually supplied with the boilers.

Fuel fired hot water boilers are generally cheaper than their steam equivalents.

All the prices quoted do not include transportation costs and goods and services tax (GST). Most manufacturers provide an installation service and these prices do not include installation charges that might be incurred.

The boiler price in most cases is only a tiny proportion of the entire installation cost. Table 1.2 shows typical installation costs for two different industries.

1.6 Market Structure

The market structure of the boiler industry in New Zealand is quite complex. Research into boilers used in the food processing industry required the direct survey of manufacturing establishments, importers of boiler equipment and reports published by people who have undertaken research into this area. One important source of information is the Marine and Industrial Department, however, attempts at obtaining information from this organisation have proved futile.

Electricity is the means of firing for one-third of New Zealand boilers. Eighty percent of electric fired boilers are in the smallest size category. These are units of one horse power (20kW) or less (for electric fired boilers the aggregate power installed -

kilowatt rating - is obtained by multiplying the horse power by twenty)*. Electric boilers are concentrated in the service sector, especially in food outlets and health/medical establishments.

Industry	Boiler type	Rating	Install/ cost ($)
Canned foods	Gas	100kW	80,000
	Electric	20kW	5,000
	Electric	3kW	1,000
Chocolate	Steam (unknown)	150kW	30,000
	Steam (unknown)	100kW	100,000
	Steam (unknown)	20kW	3,000

Table 1.2 Installation costs

The rapid development of technology has seen an increase in larger electric-fired boilers. The high price of electricity, and anticipated increases in the price, causes resistance to the acceptance of larger size categories.

Gas fired boilers cover a range of sizes, competing with electricity in the small size groups. They compete with coal and oil fired boilers in the larger size groups. The bulk of gas fired boilers are relatively new, dating back to the mid seventies when gas extraction at the Kapuni gas field started.

Coal fired boilers are weighted towards the larger sizes. Over eighty percent of coal fired boilers are over twenty years old, many dating to the period when coal was the prime industrial fuel (1960's).

Oil fired boilers are predominantly used in the range of 100 - 300kW. There has been a very pronounced decline in the proportion of boilers fired by oil since 1973, because of the Arab-Israeli war.

* Source New Zealand Boiler Stock 1982

Fig 1.1 shows a matrix for boilers depicting age and size of installation in horse power. The area around each fuel type approximates the market size.

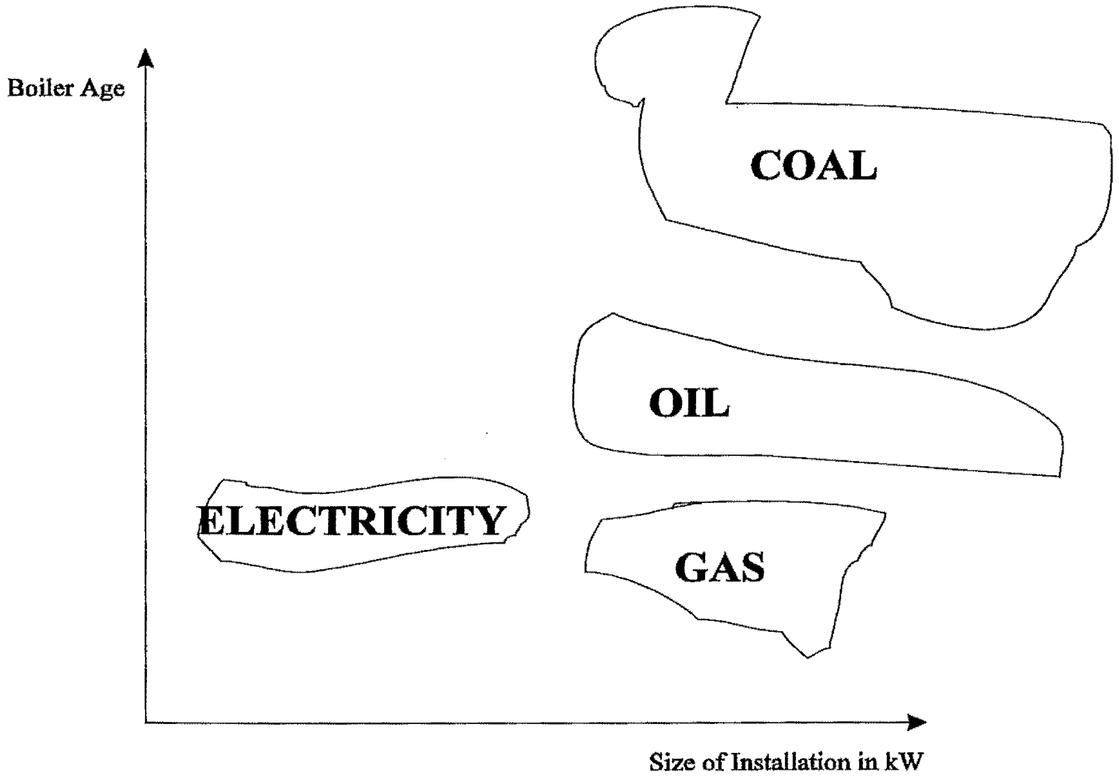

Fig 1.1 Boiler market structure

Table 1.3 shows the type of fuel by boiler size in New Zealand. This table was obtained from 1982 figures. Due to the recession in the eighties, and the recovery since 1990, it would be safe to suggest that the figures shown would be reasonably appropriate for the present New Zealand boiler numbers.

	Boiler size kW	<20	21-99	100-300	301-999	1000-1999	2000-3999	4000-9999	>10000	All sizes
Boiler Numbers										
Fuel type										
Electricity		1,663	272	75	8	2	6	1	0	2,027
Oil		28	462	1,103	234	117	103	20	7	2,074
Coal		9	63	187	142	140	169	50	11	771
Gas		383	143	228	26	19	10	7	0	816
Other fuel		7	23	70	29	28	30	13	7	207
Dual fuel		3	10	87	14	27	32	18	10	201
All fuels		2,093	973	1,750	453	333	350	109	35	6,096

Table 1.3 Type of fuel by size of boiler in New Zealand

Source: New Zealand boiler stock 1982

1.7 Customer behaviour

Most food processing industries purchase boilers to satisfy a variety of goals ranging from such primary functions as the provision of heat for integral parts of food processing to secondary functions such as cleaning and washing down of factories.

The New Zealand food industry is comprised of small industries (80%) and large industries (20%).

In small industries, the opinion leaders (for technical equipment) are the chief engineers. These engineers have valuable experience and are responsible for defining some of the operating specifications.

The chief engineer makes recommendations to the operations manager, if one is present, or in its absence a technical manager. Product requirements are established and recommendations made to the financial and managing directors for approval. In most cases the recommendations are accepted.

Large industries rely very heavily on the advice received from consultants. It is therefore necessary for boiler manufacturers to gain the confidence of food processing consultants or general consultants.

Companies involved in food processing take into consideration numerous factors in making decisions as to what sort of boiler equipment to install. Among the factors that are considered are:

- Close supplier-customer relationship - Customers prefer to have a close relationship with suppliers of boiler equipment. Suppliers are frequently expected to customise their products to meet specific customer needs.

- Location of supplier - Food companies prefer to buy boilers from firms that have a close presence in their operating areas. This eases problems such as service and the ready availability of replacement and repair parts.

- Anticipation of future needs - Food industry personnel would like equipment installed that would take care of any growth in the economy speculated by politicians.

- Location of the installation - The location of the installation (city or suburbs) determines the type of boiler that is purchased.

- Auxiliary equipment - Engineers in the food processing industry seek boilers that require the minimum amount of auxiliary equipment for operation.

- Fuel heating value and characteristics - Because of environmental concerns, fuel value and its characteristics have become very important.

- Space conditions - Lack of space may restrict some industries as to the type of boiler they purchase.

- Maintenance and operating conditions - The fuel that a boiler uses dictates the amount of maintenance and the operating conditions in terms of the staff. The trend in the industry is to move away from boilers that need to be manned to boilers that are fully or semi automated.

- Related existing equipment - In situations where existing boilers are being replaced, engineers prefer boilers that could easily be installed with minimum alterations to the already existing system. This will ensure that minimum disruption takes place.

- Cost considerations - The capital outlay required and the operating costs are important in determining which boiler to opt for.

- Reliability - Industries are interested in equipment that has been proven reliable.

- Availability - Suppliers must guarantee that boilers and spare parts are available and would be delivered on time.

1.8 Competition

Research has revealed that there is little consistency among customers when buying boilers. There are many boiler manufacturers in New Zealand. There also exists numerous distributors for boilers manufactured overseas.

In the Christchurch area, there are about ten boiler manufacturers. They range from small boiler manufacturers such as Wakefield Steam Engineering to large boiler manufacturers such as Scotts Engineering.

Wakefield Engineering is the only electrode boiler manufacturer in New Zealand. The company manufactures steam boilers in the range of 30kW to 600kW.

Scotts Engineering, on the other hand manufactures fuel fired boilers. The range of boilers manufactured are from 342kW to 2852kW.

Lyttelton Engineering Limited is a company that imports its boilers from Australia from a parent company called Maxitherm Boilers PTY Ltd. Lyttelton specialise in marine boilers although they also sell to other markets.

There are medium sized boiler manufacturers like Taylors Limited (manufacturers of the double walled shell used in two Transflux installations). Taylors manufacture both fuel fired boilers as well as electric boilers. Their electric boilers are available in sizes of 50 to 400kW. They are element boilers with removable elements in 5.55kW sections.

Burns and Farrell, and Mercers Stainless Limited, are two companies that manufacture autoclaves and food processing equipment. Most of this equipment provide a small supply of steam or hot water. These small boilers are manufactured in-house.

The most notable thermal fluid heater manufacturer in New Zealand is Aquaheat Industries Limited based in Tawa, Wellington. They are major manufacturers of boilers and thermal fluid heaters in the 82kW to 9.3MW range. They also manufacture fuel fired hot water, steam boilers, boiler accessories and burners.

Appendix 1 gives a list of the boiler manufacturers with boilers used in New Zealand.

It has been very difficult to obtain information from the boiler manufacturers as to their relative market shares and their sales figures. Most consider this as sensitive information, as it will reveal their growth rate and market shares which would put them at a commercial disadvantage. The only company that willingly gave results was Wakefield which sold three new boilers in the last three years. However, they have sold quite a few second-hand boilers in the same period.

CHAPTER 2 - THE TRANSFLUX FLUID HEATER

2.1 Project Background

The Transflux fluid heater started its development phase about six years ago. There has been ongoing research into induction heating at the University of Canterbury for the past ten years. The design of the Transflux heater was a project undertaken by Ross Walker together with his supervisor Dr Pat Bodger.

Walker designed the Transflux from what he understood of the heating theories that had been studied. However being a man of vast practical training and experience, this training assisted a great deal in translating these theories into what is now a viable commercial product.

The prototype Transflux heater was built from everyday materials and over the past three years, Walker has been fine tuning the design, he has been assisted by Dr Bodger (supervisor of the project) who carries out computer analysis and mathematical projections to facilitate the production of the heater.

2.2 Product description

Transflux heaters are a new and revolutionary technology, which heats fluids in a relatively safe, clean, and economic manner. The heating unit itself can best be described as a combination of transformer/induction/resistive heaters that convert electrical energy into heat energy of water or any fluid passed through it. Fig 2.1 shows the Transflux device.

The Transflux unit consists of two windings upon which the fundamentals of the design are based. These are the primary and secondary windings. The primary winding is wound on a coil former (jacket/load) and current is passed through this winding. The primary and secondary windings are magnetically coupled.

When current is passed through the primary winding, it induces a very low voltage across the secondary. This causes a very high current to be developed by the secondary winding across the jacket because of the low jacket resistance. The jacket serves as a load to the transformer.

The Transflux Fluid Heater

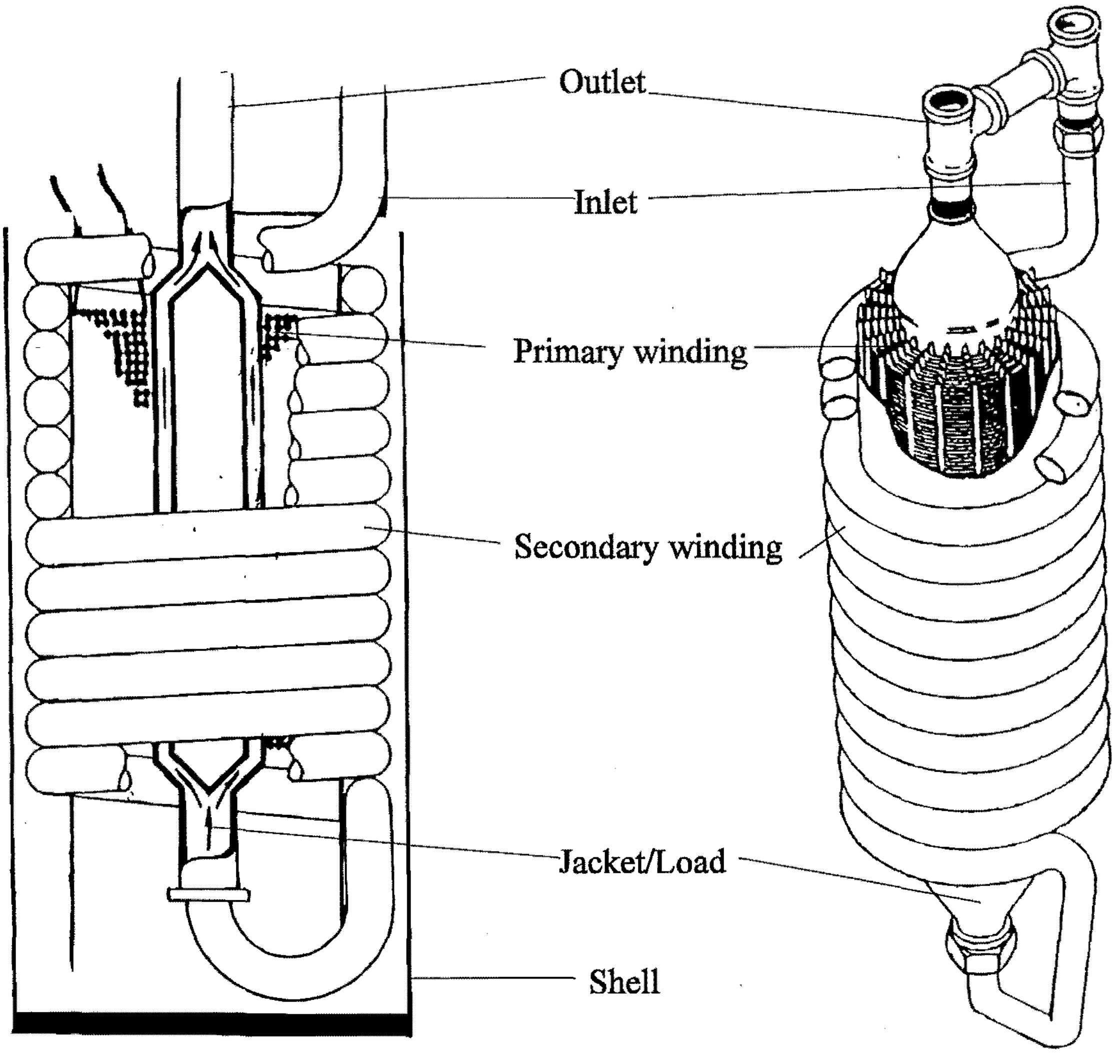

Fig 2.1 Transflux Device

Resistive heating takes place in the primary. The secondary winding has a current flowing through it and it also heats up due to resistive heating. The current is induced in the secondary winding as a result of magnetic coupling from the primary winding. Eddy current and hysteresis heating occurs in the jacket. This is induction heating. The revolutionary nature of the design makes it unnecessary to use any expensive material for magnetic coupling to ensure power transfer.

To ensure effective heat transfer and to prevent heat losses, the primary winding is cooled by circulating oil through it.

The secondary winding is made from copper piping material and the fluid to be heated flows through this pipe. This fluid acts as a cooling material for the heat which develops in the secondary winding and jacket/load. The heat developed in the oil is also transferred to the secondary winding and eventually to the fluid. This accounts for the very efficient nature of the device, as there is very little heat loss.

The entire unit is immersed in a shell. To ensure maximum heat transfer, the Transflux unit incorporates a double shelled wall. The double shell is filled with fluid and the heat from the oil preheats this fluid which then later enters the unit where it is further heated. The outer shell also keeps the device at about fluid inlet temperature.

The device heats up the fluid very quickly, and after some design refinements, the power factor is close to unity.

2.3 Product advantages

The Transflux fluid heater possesses a number of advantages which make it commercially competitive. Among the advantages are :

- Space saving - The heater is quite small and compact. There is no need for a fluid tank, or expensive storage facilities such as fuel tanks or waste tanks. There is no need for a separate boiler room as the heater can be installed near the point of use.

- Weight reduction - The small size of the heater makes it lighter than most other boilers. It is also easily transportable.

- Lower capital cost - The design of the heater requires no expensive parts or materials. The method of manufacture is simple and contributes to the low capital cost of the boiler.

- Lower installation costs - There is no need for a separate boiler room, or strong foundation to support weight. Plumbing costs are also minimised.

- Minimum maintenance - There are no exposed elements (minimises oxidation) and no moving parts. The basic components are the windings and little maintenance is required on these.

- Reliability - A heater has been rigorously tested and has successfully undergone a ten year accelerated life test.

- Cleanliness - There is no pollution, smoke ash or dust, generated by the heater.

- Rapid heat-up and response time - The heater can produce hot water or steam to the desired temperature much faster than most units.

- Safety - There is no risk of fire or flame, making it possible to install the heater in high fire risk areas. The heater can withstand high internal and external explosive pressures.

- Even heating - There are no hot spots on the device thus ensuring even heating. This makes it suitable for process heating as it will not contaminate or destroy the properties of substances that are being heated.

2.4 Current product status

Presently a number of units of varying capacities have been built. A 150 kW unit has been constructed and installed at the Wharenui swimming pool in Christchurch. This unit is made of three phases each of 50kW. It is being used in conjunction with a heat exchanger to heat the water in the pool. The unit mainly uses off-peak electricity rates to heat up the pool. This unit has completely replaced an oil fired unit which occupied an entire room.

A 50kW unit has been installed in Harolds, which is a department store in Christchurch. This unit replaces an entire boiler room and in its place a car park is being built. The unit is used for space heating.

A 100kW unit has also been built. This has been tested but at the moment no application exists for it. All the units use standard mains voltage which is 230 volts per phase. A 15kW unit is also operational. This is a demonstration unit and is usually taken to trade fairs and exhibitions. A 400 volt winding unit has been constructed and is operating according to design.

2.5 Technology protection

The Transflux fluid heater is a very simple device and could be copied very easily. It was thought worthwhile to obtain a patent for the product. In New Zealand, a patent is granted by the government after a full disclosure of the invention is made. The patent granted is for sixteen years.

The patent granted must be protected by the patentee. This might include commencing an action of infringement in the High court if it is felt that the patent is being infringed.

A Patent Co-operation Treaty (PCT) exists and it is possible to obtain patent protection by filing a PCT application and nominating any number of PCT member countries. To take advantage of PCT, a wholly owned subsidiary company was set up in Australia in 1990 to file patents in countries who are members of PCT. This company has been disbanded since New Zealand joined PCT on 1st December 1992.

The design has been improved since filing for the original patent. Filing for another patent would be extremely expensive and it is necessary to commercialise the product at this stage. The further developments that have taken place are tightly guarded and these are trade secrets known only to the inventor and those closely associated with the product.

2.6 Product requirements

The Transflux fluid heater is unique as there are no similar products in the market. Very few regulatory conditions exist. Some regulations will be defined as the product progresses along its commercialisation path.

There are certain regulations that govern the design and construction of electrical equipment with which the Transflux unit has to comply. These include part II of the Electrical Wiring Regulations 1976. This highlights such areas as the protection against contact with live parts, marking on apparatus and material and marking of cables. A label is required with the following information, which must be permanently attached to the equipment so that it is visible after installation:

Rated supply voltage
Nature of supply
Rated input current

Identification of responsible vendor or manufacturer
Model or type reference of the article

Portions of part III of the regulations also have to be complied with. This includes the safety requirements of the device and its installation, such as adequate protection against effects of leakage to earth, and protection against electric shocks.

Appendix 2 lists some other requirements that must be complied with depending on the application.

The basic design of the Transflux consists of two windings, safety isolation requirements are required between the primary and secondary winding, covering such things as insulation thickness, temperature index of the insulation, creepage distances and clearances between primary, secondary and other metal parts.

The regulations mentioned in Appendix 2 refer to hot water, and are enforced by the Ministry of Commerce. In the production of steam, some of these regulations must be met in addition to pressure vessel regulations. Most of the steam regulations come under the Marine and Industrial department which is responsible for all pressurised vessels. Appendix 3 lists some of the requirements needed for the production of steam.

2.7 Product applications

Several applications have been identified for the Transflux fluid heater. At present it has been felt that emphasis should be directed at three major markets. These markets have the greatest potential as there are several different applications in each area.

- The food processing industry - This industry was chosen because the New Zealand economy is heavily dependent on agriculture. New techniques of food processing are evolving everyday and the Transflux unit could contribute significantly towards this.

  A department of statistics survey of manufacturing (Table 2.1) in New Zealand shows that food processing is a major contributor to Gross Domestic Product (GDP). The GDP for the year was $73 billion.

Industry division	Sales & other income ($ million)
Primary food*	8238.9
Other food	5813.3
Textiles, clothing	2812.8
Wood & furniture	2382.5
Paper & printing	4503.3
Chemical	4406.4
Non metallic mineral	907.3
Basic metal	1490.1
Fabricated metal	6686.8
Other industries	364.4
Total	37605.9

* includes the processing of meat & dairy products and other primary foods. Source: Dept. of Stats.

Table 2.1 Economic Survey of manufacturing for year ended 31 March 1991

One characteristic of the food industry is the ability to heat up the food very quickly to the required temperature and cooling it again. The other important requirement is to keep all the nutrients intact. Transflux's fast response and even heating properties will ensure that these requirements are met.

- Health care industry - There is significant restructuring at present in this industry. It is envisaged that there would be smaller health facilities opening up in the entire country. The health industry is presently a growing enterprise as people are becoming more health conscious.

  A lot of hot water and steam is used in saunas and spas. The Transflux unit being small and efficient could cater for this growing market. In hospitals, sterilisation of equipment is essential and autoclaves are used for this. These require the production of steam. Many hospitals are now moving from using big central autoclaves to smaller point of use systems with a local supply of steam.

- Other commercial and industrial applications - The New Zealand economy is recovering from a period of restructuring and the government is encouraging investment in industry and commercial ventures.

There are several applications that require the use of either hot water or steam. These could be provided by using a Transflux heater. Among the applications that are presently being considered are: Waste oil refining; Humidifiers; Space heating; Hot water for aircraft galleys; Swimming pools; Chemical and process applications.

CHAPTER 3 - MARKETING PLAN

3.1 Strengths/Weaknesses Analysis

Strengths

In order for Transflux Developments to be competitive, it must possess certain strengths. It's strengths are:

- Service - Two products are being marketed, namely heat and engineering services. Heat is the basic product, and engineering services is part of the augmented product. Most boiler manufacturers provide only heat facilities (boilers).

- Warranty - Transflux Developments provide a full one year warranty for all products. Valuable data obtained from test sites further enhances the development of the product.

- Underwriting - Transflux Developments has the backing of ECNZ. They have underwritten each product and will help in its replacement if the product fails.

- Marketing - Transflux Developments has at its disposal the use of Southpower marketing expertise. Southpower receives a lot of requests for improvements in heating facilities. Theses requests are helpful leads for Transflux Developments.

- Personnel - The Transflux team has technical and business people who have dealt with a number of innovative products before.

- Low manufacturing costs - The manufacturing is being done at the Electrical and Electronic Engineering department workshop. Overheads are presently being carried by the university.

Weaknesses

Some of the weaknesses of the company are:

- Resources - Transflux Developments is competing against companies who have vast resources for research and development, as well as marketing.

Transflux is dependent on Southpower for financial backing and is restricted in its resource capabilities.

- Leverage - Transflux Developments cannot exert any significant leverage on its suppliers, due to the small quantities being purchased.

- Demand - If a significant amount of demand is created, this will be unsatisfied due to inadequate resources.

- Priority - At present no priority list exists as to how R&D should progress. A priority list is essential if future needs are to be met.

- Transflux Developments lacks a proper management structure. There is no one at present driving the research as well as the marketing of the product. This creates a breakdown in communication between the various people involved in the project.

3.2 Opportunities/Threats Analysis

There are certain opportunities and threats in the Transflux macroenvironment.

<u>**Opportunities**</u>

- Recovery of New Zealand economy - The past three years have seen a dramatic recovery in the New Zealand economy from recession. There has been a boom in the agricultural sector of the economy. With the increase in input increased heat facilities are needed.

- Small businesses - The government has given a commitment to help small businesses build on the growth that has been achieved over the past three years. Most of these companies are using electrical means of producing heat.

- Environmental awareness - Industries are turning towards cleaner methods of producing heat and electricity and Transflux are viable options to be considered.

- Changing customer patterns - Customers have realised that running huge centralised boilers waste resources. Some have been changing from large centralised boilers to having several small boilers at point of use. This offers savings in fuel costs and having the boilers on only when needed. Most of the customers who have changed are opting for the use of small electric boilers.

Threats

- Financing - Most fuel companies are offering financial packages to influence boiler users to buy boilers using their respective fuels.

- Demand - It is most unlikely that new power stations will be built in the next five years. If customers switch from fossil fuels to electricity, there will be a great demand on the existing electricity structure. This would cause electricity prices to rise due to the fundamental economic theories of supply and demand.

- Competitors - Many boiler manufacturers were contacted just after the breakthrough with the Transflux unit. Most of these manufacturers were uninterested in the product. However, such companies are known to harass smaller companies when these small companies start to take business from them.

- Legal - It is quite common for large overseas companies to infringe on the patent rights of smaller companies.

- Natural environment - In order to meet the increased demand of electricity in the coming years, electricity generating companies will have a great deal of controversy with environmentally conscious individuals. The result of this will be an increase in the price of electricity.

3.3 Objectives

Transflux Developments has the following objectives for the Transflux fluid heater:

- Building awareness - The product is relatively new and it is necessary to build awareness of it in the food processing industry.

- Obtaining test sites - The product has been identified as suitable, but not yet tested for the food processing industry. With test sites obtained, the product will be vigorously tested and any modifications necessary will be done.

- Market - It is proposed to pursue industries needing small heating facilities in both hot water and steam applications. These requirements would be of such a nature that it will be uneconomical to run conventional boilers.

- Bottlenecks - Transflux Developments intends to boost the productive capability of food processing industries by providing a service wherever bottlenecks exist in present systems.

- Satisfaction - Transflux Developments aim to satisfy the customers with regard to maintenance and after sales service.

- Growth - Intensive growth opportunities will be pursued. This will come about by ongoing research into finding new and improved applications for the Transflux fluid heater.

- Return on Investment - To attain a return on investment of twenty five percent by 1997.

- Licensing - To license the product after development to an established company with extensive marketing capabilities and obtaining royalties from the sale of the product.

3.4 Marketing Strategy

The strategies that must be in place to attain the above objectives are outlined in the following sub-sections.

3.4.1 Target markets

A number of target markets have been identified in the food processing industry. These markets could benefit from the use of a Transflux device to increase production as well as providing an efficient service.

The markets outlined below are by no means the only markets, two further applications are discussed in Appendix 4.

- **Brewing industry** - The brewing industry requires considerable heat for various processes. The Processes range from boiling of malt, the pasteurisation of beer to the packaging of the beer. At present breweries use steam jacketed kettles for boiling malt and plate heat exchangers for pasteurisation. In most breweries, steam is fed from a central boiler house.

During pasteurisation, the beer has to be maintained at a temperature of around 73.5°C. The beer is pasteurised by using two sets of plate heat exchangers. The first set provides hot water from steam and the second, pasteurises the beer.

Beer is packaged either in cans, bottles or kegs. Reusable bottles are cleaned by using hot water. The filled cans, bottles and kegs are also cleaned using hot water.

The Transflux unit is suitable for certain sections of the brewing industry where bottlenecks occur in the system. In keg packaging, the beer has to be pasteurised and this requires hot water at a temperature of 73.5°C. Keg packaging takes place seven days a week. Steam is provided by huge central boilers and this becomes uneconomical during the weekend as only small quantities are needed. The whole keg operation could be fed from a single Transflux unit which would minimise the costs to the brewery as a whole. Using a Transflux in this operation would also reduce the amount of equipment needed, as only one plate heat exchanger will be needed.

In brewery cleaning operations, steam and hot water is used and in the absence of venturi mixers, serious injuries can result. A Transflux unit would reduce these risks as the cleaning temperature could be carefully controlled by the design of the heater. There are considerable heat losses on the whole system. Transflux units distributed throughout the brewery would minimise energy losses.

The Transflux unit could be used to provide all heating requirements for micro-breweries which are increasing in number especially in bars and restaurants. These breweries are small and have a capacity of no more than five hundred litres. Purchasing a conventional boiler adds significantly to the price of the local brew. Buying a cheap Transflux could make the brew more competitive.

Appendix 5 gives a breakdown of the result of the survey on breweries.

- **Rendering and curing of hams and sausages** - Numerous quantities of hams and sausages are consumed in New Zealand especially during the summer months when there are many barbeques.

Hams and sausages have to be precooked. Precooking normally takes place in a cooking tunnel. These tunnels vary in size, but the standard size is normally, seven metres long, two metres high and around 1.5 metres wide.

The cooking tunnels are fed with steam from a central boiler. Significant losses of heat result from this. The cooking tunnels are required to be held at a temperature of 80°C and the pressure of the steam being fed to the tunnels is around 80psi. The hams and sausages are cooked until the internal temperature is 80°C.

In most ham and sausage factories, there are various tunnels and not all of them may be operational at any one time. However, since only one central boiler is available, the boiler has to be running whenever cooking is taking place.

Most industries use fossil fuel fired boilers and a lot of maintenance is required on the boilers. A particular look was made at one such industry and it was found that maintenance of the boiler for a year was around $7000.

The suitable application for the Transflux unit would be to replace a central boiler with one Transflux per cooking tunnel. The Transflux would only need to be turned on if there is cooking taking place in the tunnel.

Steam is directly injected to the foods. However, the boilers have to be treated with various chemicals, and it is not desirable to have direct steam injection. Industries prefer boilers that will need very little treatment.

The Transflux unit could also be used for washing down of floors and cleaning of equipment. As mentioned in the previous section, the absence of venturi mixers is hazardous for the workers.

- **Dairy industry** - The dairy industry is an area where heat is used extensively. Heating milk is the backbone of the industry. Milk sold on the New Zealand market is required by law to be pasteurised.

  Dairy product exports constitute some 20% of total merchandise trade receipts for New Zealand. Table 3.1 gives an idea of the amount of milk produced in New Zealand.

Product	87-88	88-89	89-90	90-91	91-92
Production	million litres				
Total milk production	7705	6969	7302	7509	7871
Utilisation					
Vol. town milk sales	342	341	334	336	364
Milk sent to factory	6921	6533	6868	7078	7441

Source: NZ Dairy Board

Table 3.1 Milk production and utilisation

The Dairy industry in New Zealand spends around $10 million in heating equipment each year. The operating costs for running all the boilers and other associated equipment is around $37 million.

There are presently 16 co-operative dairy companies which operate around 40 dairy factories in New Zealand.

In the pasteurisation of milk, the milk has to be heated up to 85°C from 4°C. It is then cooled to 4°C again. The response rate must be very fast in order to ensure proper treatment. In the case of long life milk, it is necessary to heat the milk to a temperature of 140°C and cool it again.

In most dairy factories, a water set is used in conjunction with plate heat exchangers. Two sets of heat exchangers are used, the first set is to heat hot water to the desired temperature and the second to heat the milk up. The milk flows from a tank to the heat exchanger where it is heated by the water to 85°C. This hot milk then flows through a regenerator which is another heat exchanger. The hot milk is used to heat up the cold milk, thus saving in energy.

The Transflux unit could be used to provide hot water which could be used together with a plate heat exchanger to heat up the milk. It would only be feasible to use a Transflux in small applications. The capital cost of setting up such a system could be minimised as only a regenerator will be needed, and the milk could be passed directly through a Transflux unit made of stainless steel.

The dairy industry is on the leading edge of new technology in the production of dairy products and many systems in use in the industry were adopted before they were commercially proven elsewhere in the world.

- **Canned Foods industry** - This industry makes use of steam. the industry also uses huge amounts of hot water to add to products that are being cooked.

  Steam is used for cooking which takes place in cooking vats. These vats are open to the atmosphere, and the pressure of steam is atmospheric.

  The cooked food is canned in a process that does not require hot water or steam. After canning, the cans are sterilised. Autoclaves are used for sterilisation. These autoclaves are quite similar to those used in the medical market, however, the operating conditions are different. The sterilisation temperature is 121°C. The pressure of steam should be around 15psi.

  Most small businesses are becoming quite sophisticated in the technology that is employed in canning and Transflux could play an important part in providing heating applications for these industries. In larger industries, the plant size is normally very large (Watties in Hastings over 1 kilometre long), steam is carried in pipes and significant losses occur. Most of these industries have been installing point of use heating facilities where there are serious bottlenecks in the existing system.

  Appendix 6 shows the results of two canned food industries that returned the questionnaire sent out to them

- **Dehydration of mushrooms** - Mushrooms have to be dehydrated before being used for food processing, or before being exported. The dehydration process is quite simple. It involves the blowing of hot air over the mushrooms for forty hours. The air needs to be maintained at a temperature of 80°C. Air is provided by using a fan. Most mushroom dehydrating plants use oil burners and a heat exchanger for the process. The present process is very inefficient.

Transflux units could be used as an alternative. The heaters could be used as thermal fluid heaters and oil can be pumped through heat exchangers. The advantages of using a thermal fluid heater have been explained in section 1.4.

Present oil burners used are old and they are only about 50% efficient. Using a Transflux could improve productivity in that the mushrooms will be completely dehydrated in about twenty four hours. Appendix 7 gives details of a mushroom dehydration plant.

A selection matrix (Table 3.2) has been created for the industries mentioned above. This matrix was created on the basis of prevailing conditions in the market place and market opportunities created by the present economic situation. A set of weightings was put on each condition to determine its importance. Each industry was analysed out of a scale of ten on each factor and this was multiplied by the factors weight to get the final score.

The brewing and dairy industries were found to be more attractive than the other industries. There are many micro-breweries opening all over the country. These breweries will be very interested in adopting a Transflux because of the lower capital costs. The popularity of keg packaging is also another attribute in increasing attractiveness, particularly in large breweries.

The attractiveness of the dairy industry is due to the need for local milk supplies for small towns. Small suppliers want to set up their own processing plants and the Transflux could cater for this adequately. The possibility of eliminating some of the auxiliary equipment has also increased its attractiveness in large milk installations.

The other three industries are rated close together. The Ham and sausage industry scored low because the processing is done by big companies. These companies already have plant and equipment installed. However, there is potential in this industry in terms of the increase in productivity to be achieved, and the lowering of production costs. This is as a result of being able to operate cooking tunnels whenever the need arises, instead of running central boilers continuously.

The mushroom dehydration industry is small and sales to this sector would be small.

Parameter #	Weights		Brewing	Hams & Sausages	Dairy Industry	Canned Foods	Mushroom Dehydration
1	8	Local Market (1-small; 10-large)	8	4	7	6	3
2	2	Local Expertise(1-low; 10-high)	7	5	8	6	5
3	4	New heater installation market (1-small; 10-Large)	7	4	4	7	3
4	6	Heater replacement market(1-small: 10-large)	5	3	5	5	5
5	2	T/F drives the sale(1-low: 10 High)	4	2	2	3	2
6	5	Space available(1-large; 10-small)	5	4	3	3	4
7	4	Accuracy of control required (1-low; 10-high)	8	7	9	5	4
8	4	sales cycle(1-long; 10-short)	6	3	4	2	2
9	4	Increase in productivity due to Transflux (1-low; 10-high)	5	4	3	1	7
10	6	Capital costs(1-small; 10-high)	5	5	4	4	4
11	6	New product adoption proclivity (1-low; 10-high)	5	7	4	4	6
12	4	Sales channel (1= indirect, 10= direct)	7	5	3	6	6
13	7	Payment terms (1=long, 10=up front cash)	6	5	5	2	1
14	6	Customisation of design required (1=low, 10= high)	3	4	8	6	8
15	8	General health of industry (1= poor, 10= good)	9	8	9	5	4
16	6	Intensity of competition (1=high, 10=low)	4	4	4	6	9
		Total	489	395	440	369	377

Table 3.2 Selection matrix for industries

3.4.2 Positioning

The Transflux unit has to be differentiated and positioned so that it will be able to capture portions of the markets described above, that other boiler manufacturers are not providing. This will allow the company to charge a price premium based on the extra value being offered to the customers.

Transflux has been differentiated product-wise as well as the services offered by Transflux Developments. Figures 3.1a-f shows different ways in which Transflux is perceived when compared to the competition.

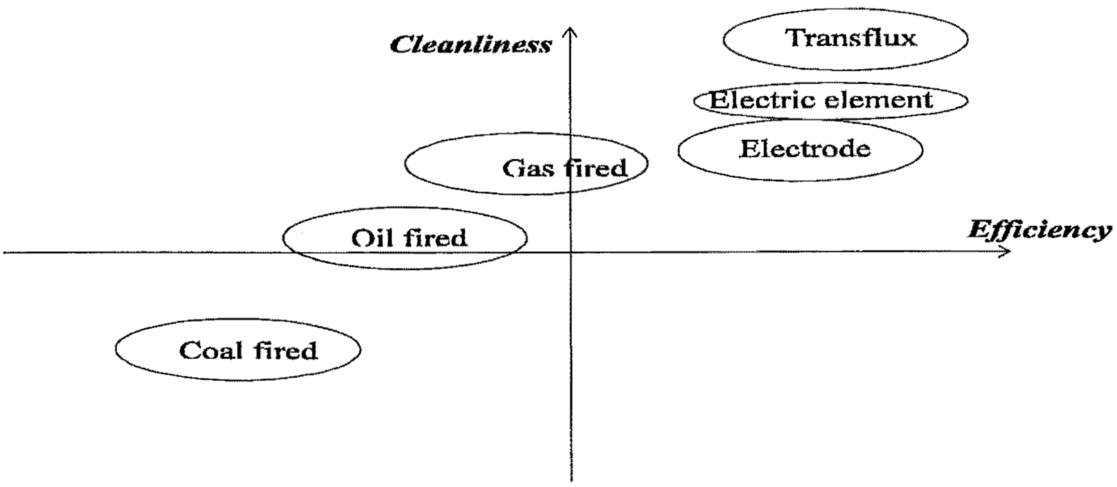

Fig 3.1a Positioning of Transflux relative to competition

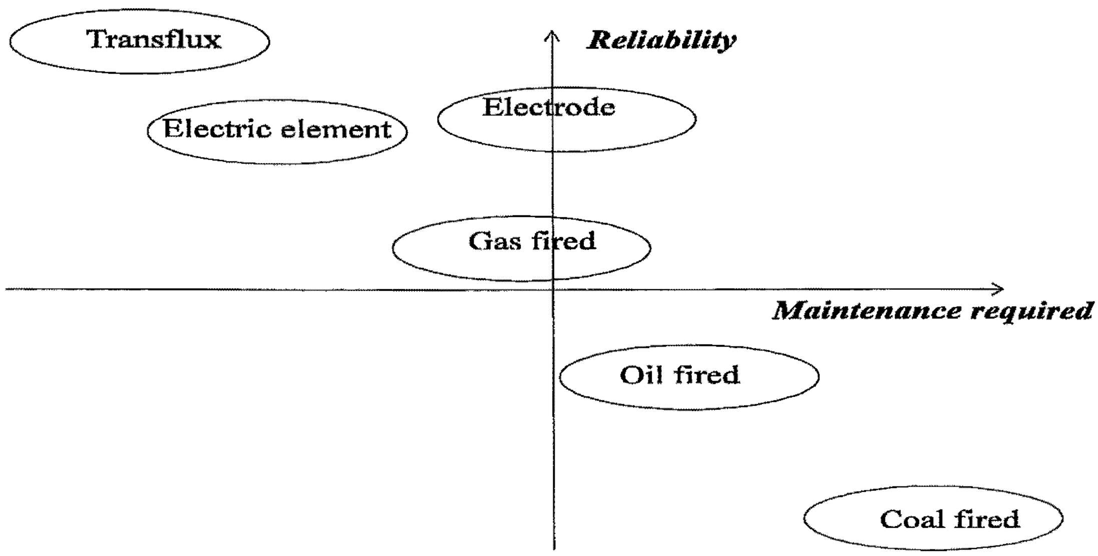

Fig 3.1b Positioning of Transflux relative to competition

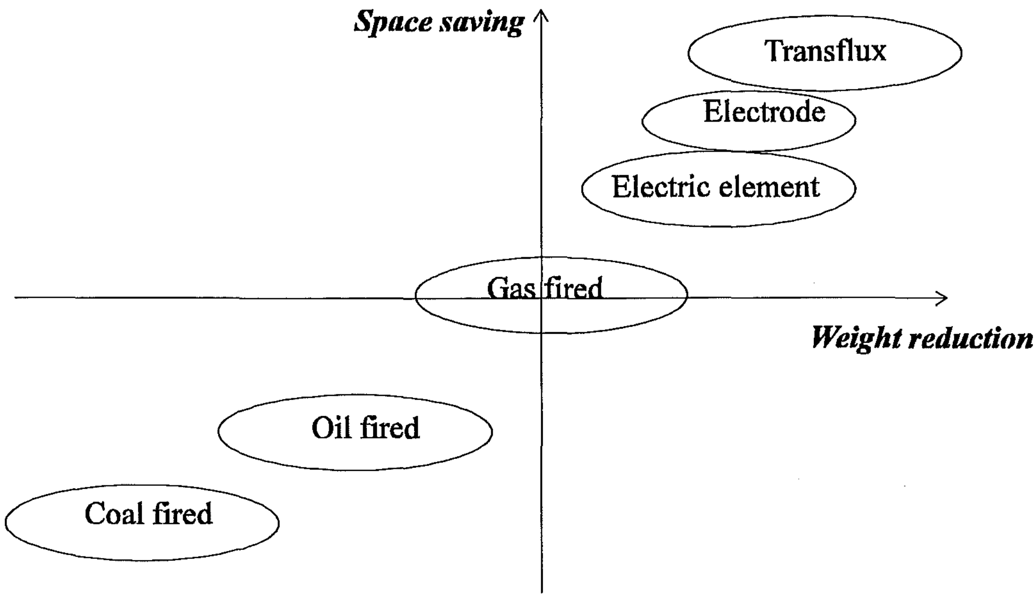

Fig 3.1c Positioning of Transflux relative to competition

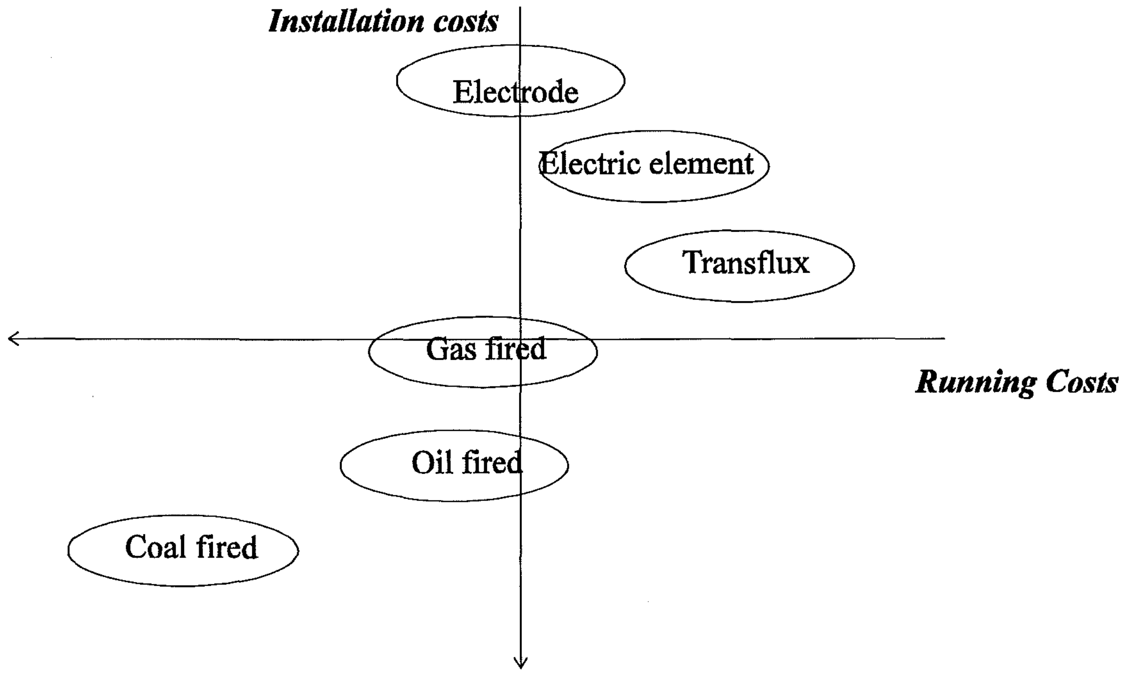

Fig 3.1d Positioning of Transflux relative to competition

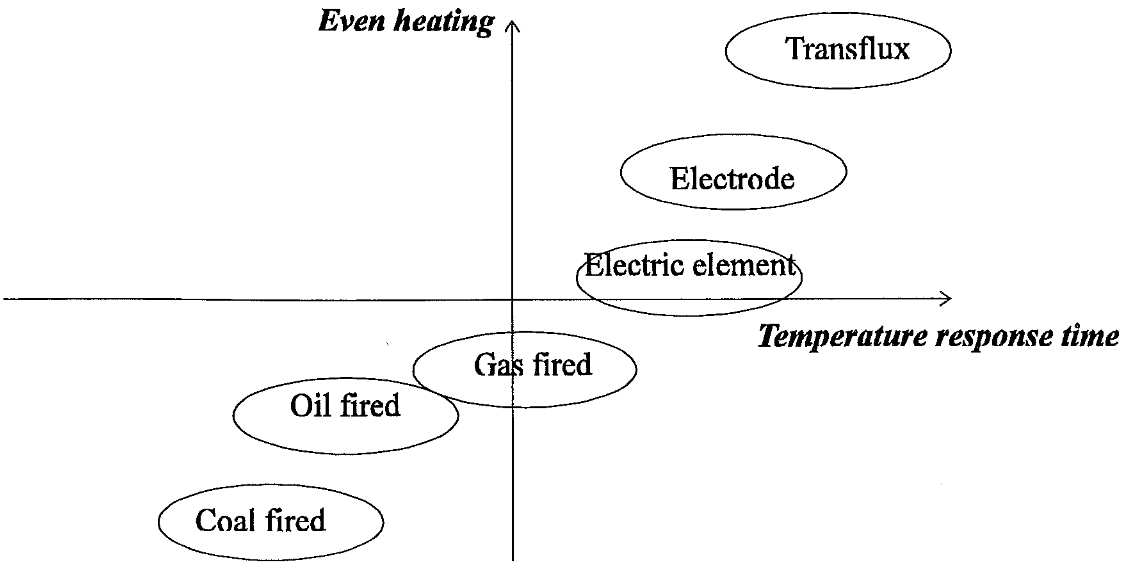

Fig 3.1e Positioning of Transflux relative to competition

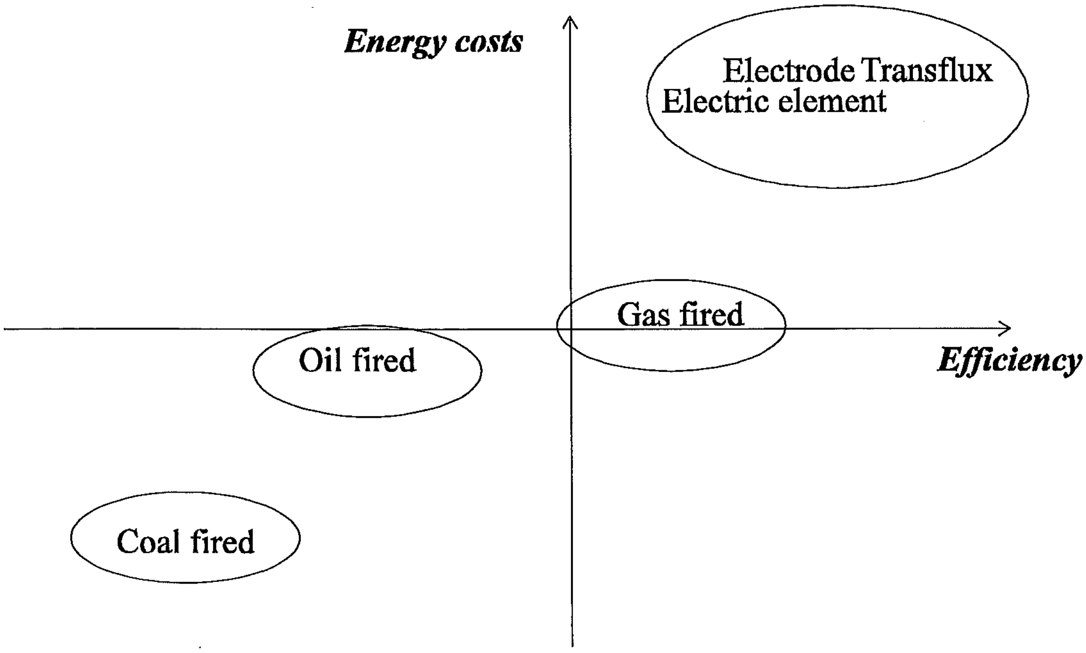

Fig 3.1f Positioning of Transflux relative to competition

The above figures show that the extent of the value added with the use of Transflux compared to other systems. The Transflux unit has characteristics that supplement the product's basic function which is the production of heat. This includes its fast response time and its even heating capability.

The Transflux is cheaper to manufacture than other products. However, the installation cost at present is higher than electrode and element boilers because of not being a completely packaged unit. Outside components have to be purchased which raises the price of the installation.

The perceptual maps show that the Transflux unit performs better than fuel-fired boilers in most departments. However, the energy costs of running electrical units are higher than running fossil fuel-fired units. Customers look at energy costs as well as labour costs, capital costs, maintenance costs, when purchasing a boiler. The main difference between Transflux and other electrical units are in size, reliability, response time, cost and even-heating properties.

Transflux Developments is different from the other boiler manufacturers in terms of services offered. The strategy at present is to design customised units after close consultation with the customer.

Transflux Developments takes care of all installation requirements to make the product operational. At present Transflux Developments provides a free installation service, however, this would change as the company grows.

Consulting services are presently being offered free of charge. These services are being offered in the form of working with the customer to determine requirements and helping define a solution.

Transflux Developments provides a full warranty for one year. This caters for problems that may arise through malfunctioning of the equipment. This does not cater for man-handling of the equipment by the customer.

3.4.3 Marketing mix

<u>Product</u>

Transflux Developments has to concentrate on what has already been achieved and try to consolidate this. Units of 50kW, 100kW and 150kW ratings have been designed and the present technology allows for up to 250kW units to be designed without significant changes. Applications in the industries mentioned that require the use of a heater in the range of 50-250kW should be pursued. Transflux heaters are now in the introduction stage of the product life cycle and must thus offer a basic product. This will build up the reputation of the product in this niche (small heat applications).

It is also of utmost importance that product development continues in these areas, as technology is in a state of constant evolution. To stay competitive, Transflux Developments must continuously do research and development.

Research and Development

Research conducted has shown that there is great potential in the heater market for steam units. A steam unit has been built and is currently with Mercers - manufacturers of autoclaves and steam equipment - for testing. An expert in steam devices will be sought to help in further development of the steam unit. There are numerous conditions to be met when testing steam as explosive pressures are normally involved. Some of the steam requirements are discussed in Appendix 3.

Research will also continue into further enhancement of the product. Cleaning the equipment at present is difficult. Any build-up of scale in the pipe would be difficult to eliminate. In the new proposed design (Fig 3.2), the secondary winding would be a single turn. This would make it easier to maintain and repair. The primary winding would fit into the centre and faulty windings could be easily removed and replaced.

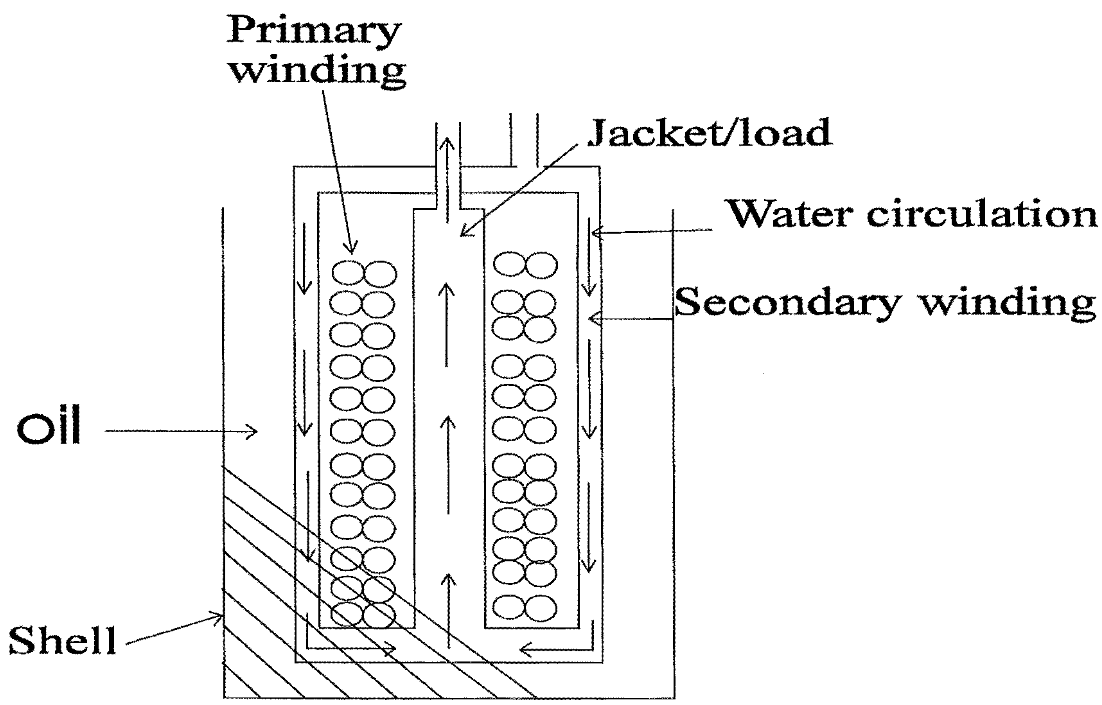

Fig 3.2 Cross section of new proposed design

A 400/230 volt unit will be designed. This unit would have dual functions. It will be capable of operating at 400 volts during off-peak times and at 230 volts during peak hours. At 400 volts operation will be at the rated power and at 230 volts, operation will be at one-third of the rated power. This will provide some method of control for peak and off-peak heating. A star-delta wiring configuration would be required to achieve this.

Market research has shown that there is potential for hot water and steam devices that have large ratings. To design a heater in the megawatt range would require a very high voltage. At present an 11kV model has been computer designed and analysed. Development of higher range units would be left to a future licensee.

Transflux units do not make provisions for water treatment. Most water contains magnesium nitrate, carbonates and silicates. These substances cause corrosion and scaling in boilers. In future designs, provisions will be made for blowdown of any scale that may occur in the jacket/load. This would be accomplished by putting a valve at the bottom of the unit (the connection between the secondary and the load). This can be opened and blowdown can occur whenever necessary. Transflux will work closely with a local water treatment company to determine the corrosive nature of the copper that is used in the piping.

Presently control units are unavailable. Control units could be bought but are expensive. Research has found that controllability of the unit is of utmost importance and in all cases intending customers have raised concern about the control capabilities. It is envisaged that a research student will be given a scholarship in the Department of Electrical and Electronic Engineering to carry out extensive research into developing a control unit. This will facilitate the selling of the unit as a packaged unit. Work has already started in developing a simple control unit.

Promotion

Transflux Developments will undertake three types of promotion strategies if it is to effectively sell units in an already crowded heating market. These three promotional strategies will be carefully coordinated in order to achieve any significant result. The promotion mix will consist of:

- **Public Relations** - A variety of programs designed to improve, maintain, or protect a company or product image.[1]

- **Sales Promotion** - Short-term incentives to encourage purchase or sale of a product or service.[2]

- **Personal Selling** - Oral presentation with one or more prospective purchasers for the purpose of making sales.[3]

Public Relations - This campaign will be started from the beginning of 1994 and will continue for a period of around two years. This will be an effective way of building awareness of the Transflux unit.

Transflux Developments will get the services of a PR consultant, and news worthy articles would be aired on programs that have high ratings particularly in the television medium.

Newsworthy articles would be placed in newspapers and magazines that have a relationship with the food industry to attract attention, as well as to provide information. There are food technology magazines and Transflux will seek to get articles in these magazines. Information is regularly documented by the Crop and Food Research Institute based at Lincoln which is sent to interested parties. Transflux Developments have already made contact with this institute. Brochures will be sent out to the food industry to inform them where the product is at the moment.

Transflux will take part in trade fairs and exhibitions. Many opportunities and information arise from such exhibitions. A recent exhibition at the Canterbury Horticultural Centre produced ideas on thermal insulation which had not been considered before.

Public relations has many advantages. Many industries avoid talking with people involved in new technologies. However, news stories and features provides the feeling that there is more authenticity and credibility in the story.

Sales promotion - These methods will be used during the testing of the product in the test sites. It is a method of providing incentives to the customer to try and buy the product. Transflux Developments aims to get as many test sites as possible to try the product. Discounts will be offered to the customers who are willing to provide test sites by providing the units to them at a price which is less than what the market can carry. The service received will be the best as the reputation of the company and its product depends a lot on what these customers think.

Personal selling - The Transflux fluid heater is a specialised product. There will be a significant amount of personal selling during the testing phase and after. So far some amount of personal selling has taken place and this has occurred during the research period. Personal selling involves two or more people meeting and making a presentation.

Potential buyers would like to have as much information as possible about the product before considering whether to buy. They will not rely entirely on media hype created by the public relations campaign, they will seek the opinions of knowledgeable sources.

A credible personal selling team (salesforce) will be established, to reach potential buyers. This will be done in 1996 when the South Island roll out is about to begin. Transflux will aim to satisfy customers as a satisfied customer indirectly becomes a member of the sales team. Through personal selling, a relationship will be built which will have several advantages to Transflux Developments. Some customers have a lot of ideas and only after interaction with them will those ideas be voiced. Some of these ideas could improve the product significantly.

Place

> *A distribution system.... is a key external resource. Normally it takes years to build and it is not easily changed. It ranks in importance with key internal resources such as manufacturing, research, engineering, and field sales personnel and facilities. It represents a commitment to a set of policies and practices that constitute the basic fabric on which is woven an extensive set of long-term relationships.*[4]

The best approach in distributing the heater to the industries mentioned above will be a direct distribution system. The heater will be sold without the use of intermediaries. Transflux will be unable to offer significant margins to intermediaries for them to carry the product.

Distribution of the heater for the first two years will be confined within the Canterbury region in general and the Christchurch area in particular. The main aim is to establish a few test sites. In order to effectively manage these sites and obtain useful information from them, they must be very close to the Transflux technical wing. Valuable information will be obtained from these sites and significant improvements would be able to be made to the product due to its close proximity.

At the end of the second year, the product will be launched in the South Island. There is a much bigger market in the North Island and the roll out will start in 1997. The North Island venture will start in the Waikato region. The Waikato region is well known for being one of the great agricultural regions of New Zealand.

After the sixth year, the unit will be licensed to a multi national or a well established local company. This company will be responsible for distribution and royalties will be forthcoming for Transflux Holdings. Table 3.3 shows the distribution of the product for the next six years

YEAR	PLACE
1994	Christchurch
1995	Christchurch/Canterbury
1996	South Island
1997	South Island/Waikato
1998	South Island/North Island
1999	South Island/North Island
2000	License

Table 3.3 Product distribution

Price

The estimates of the cost of producing Transflux units of differing output ratings are outlined in Appendix 8. These are not true costs since some of the components of the cost (overheads) are not being absorbed by Transflux Developments. The costs shown also do not take into account the level of production and the cost behaviour as a function of accumulated production (the experience curve).

The Transflux unit uses cheap materials, and a premium price could be charged as a result of the value that can be obtained. A premium price means evaluating the benefits that can be obtained from using a Transflux in the food industry, compared to other forms of heating, before setting a price.

During the testing phase, the pricing strategy will be one of rapid penetration. This means a low price will be charged (sales promotion) and high promotion will be carried out (PR and personal selling). This strategy will bring about the fastest market penetration that Transflux Developments needs at this stage. This strategy makes sense when (1) the market is large; (2) the market is unaware of the product; (3) most buyers are price sensitive; (4) there is strong potential competition; and (5) the company's unit manufacturing costs fall with the scale of production and accumulated manufacturing experience.[5]

The price that Transflux Development charges for the units will ultimately determine how many units are sold. If the unit is overcharged, very little demand will be created.

In large food industries that need the Transflux to supplement their present operations, too high a price will prevent them from buying the units. However, in new industries (small) that are setting up, a high price could be charged as it would be unwise of them to get alternate systems which will not cater to their every need. The Transflux could be designed just right for them and they will be willing to pay a high price.

The price charged by competitors have already been discussed in section 1.3. These prices will be considered when setting the market price of a Transflux unit. In the perceptual maps, Transflux has been positioned close to electric boilers (element and electrode). The prices that will be charged will not have large variances from these units as the perceptual maps have shown. The buyer's perception of the unit thus becomes critical and this will only be accurately known after the test procedures have been completed in the next two years.

Customers in Christchurch will not be charged for freight during the first two years as Transflux Development's double cabin truck will be used for delivery.

3.5 Market Research

The marketing research that has been carried out to date has been focussed in the Christchurch region which is where distribution will start.

Transflux Developments will monitor the technological environment very closely. New ideas are always being developed some of which might threaten the existence of the Transflux unit.

Everyone associated with the company will take part in market research. Ideas would be encouraged to flow from the team to customers and vice versa. The team that would be responsible for personal selling will also be the ears and eyes of the company.

The direct expenditure on market research thus far stands at $6000. This is for a period of six months from September 1993 to February 1994. It is hoped that some MEM students will be recruited to continue where the present group left off. $15,000 will be allocated for research

A post purchase survey of test sites will be carried out, to evaluate customer satisfaction. This will ensure that the shortcomings of Transflux are noted and improvements made.

3.6 Selling Strategy

The selling strategy will include substantial amounts of sales promotion and personal selling.

An effective salesforce will be required. At present this is being carried out by the research team from the university (MEM students) as well as two employees of Southpower.

The selling strategy will be based on the customer focus technique

Customer needs	Customer focused marketing	Customer satisfaction creates profit

Fig 3.3 The customer focus technique

Customer focused marketing means that every arm of Transflux Developments will be well coordinated. The technical team will consult with the sales team and vice versa. This coordination will ensure that the company does not go off track.

The customer focus technique to be put in place by Transflux Developments will consist of five basic steps:

1. Gain respect - The respect of the customer will be earned through attention, interest and interactive rapport.

2. Need recognition - Questioning will help establish the need, together with listening and evaluation of customer responses. A thorough knowledge of the product and

its application is essential or the necessary connection between need and product might be overlooked.

3. Customer recognition - The customer will be assisted in recognising needs.

4. Solution - The product and how it will solve the customer needs will be explained.

5. Close - The finalisation of the sale.

By satisfying customers, then through word of mouth, messages will reach all corners of the New Zealand food industry. Thus profits will arise as a by-product of customer satisfaction. Profits will be the reward for a job well done.

Some companies would not be interested in purchasing the Transflux unit out right. Leasing or hire-purchase will be done in exceptional cases only. This will not be encouraged as it will create cash flow problems for the company. It is hoped that acceptable solutions will be reached with all potential customers without detriment to the company or customer.

The Transflux units are under warranty for one year. After the first year of operation, service contracts will be offered to interested customers.

3.7 Control

Transflux Developments will carefully monitor its program in order to survive in the market place. All the activities mentioned in the previous sections will be controlled and monitored in order to see whether the company is performing according to expectations. If the result is otherwise, corrective measures will be taken, or the whole program will be reviewed.

The objectives of Transflux (section 3.3) has been clearly set, and these objectives will help in the controlling of the marketing effort.

The financial statements in Appendix 15 will provide a means of monitoring the entire Transflux program. Financial ratios will be calculated and these ratios will be indicators of various important factors in determining whether the business is on course.

The control program will ensure that the marketing research is being properly carried out. Environmental conditions will be monitored to take advantage of changes in the economy and customer preferences.

Presently the only control system in place is technical. Causes of failure are determined and corrected. This will be vigorously pursued over the next two years as new test sites are commissioned. This will help improve the product to the customers satisfaction.

Profitability analysis will be carried out on the various sizes to see which unit is more profitable to manufacture.

These programs are critical as strategic control is essential when new products are being introduced. Entering a market with a new product is risky as there is rapid obsolescence of objectives, policies and strategies. An effective control procedure will ensure that changes are made as they become appropriate.

3.8 Market risks

- The Transflux unit uses electricity and it is generally perceived that electricity is expensive. The unit price of electricity coupled with capacity charges have an adverse effect on the adoption of the heater.

- Transflux is in its testing phase and breakdowns will occur from time to time. This will assist in improving the product. Certain industries cannot afford to have breakdowns in certain operations as the losses incurred could be phenomenal.

- Due to the present manufacturing process, repairs cannot be done on customer sites. The unit might have to be removed wasting valuable time.

- Charges might be incurred by customers in upgrading their electricity supplies as present cables might be too small.

REFERENCES:

1. Kotler, P. Marketing Management Analysis, Planning, Implementation and Control 7th Edition

2. Kotler, P. Marketing Management Analysis, Planning, Implementation and Control 7th Edition

3. Marketing definitions: A glossary of marketing terms (Chicago: American Marketing Association, 1960)

4. Corey, E.R. Industrial Marketing: Cases and concepts (Englewood Cliffs, N.J.: Prentice-Hall 1976 p.263)

5. Kotler, P. Marketing Management Analysis, Planning, Implementation and Control 7th Edition

CHAPTER 4 - ORGANISATIONAL ANALYSIS

4.1 Present company structure

The entire Transflux operations comprises of two companies. The first is Transflux Holdings Limited. Transflux Holdings Limited is a non-trading company established in 1989 and it was set up to direct the research and development and to patent the novel heater researched and developed in the university. This company holds the intellectual property rights.

During the research stage, funding for the project was provided by Southpower, the regional electricity supply authority. The ownership of the non-trading company is made up of Southpower with 50%, Messrs Bodger and Walker each have 20% and the University of Canterbury has 10%.

To take advantage of PCT, a wholly owned subsidiary company called Watson PTY was set up in Australia in 1990 to file patents in countries who are members of PCT. This company has since been disbanded

Transflux Holdings Ltd has a Board of Directors comprising people from Southpower, the University of Canterbury and Messrs Bodger and Walker.

The second company that has been formed for the Transflux operation is Transflux Developments Limited. This company was set up to initiate market applications for the product. The company was also set up to consider entering into licensing agreements with commercial manufacturers to produce and distribute the device to generate a revenue stream to both Development and Holding companies. The Holding company is to transfer patent rights with a master licence agreement to the Development company.

The Development company has not been formally constituted. The arrangement gives Southpower complete ownership of the Development company. Southpower in turn has provided funding of $250,000. Fig 4.1 illustrates the present Transflux structure.

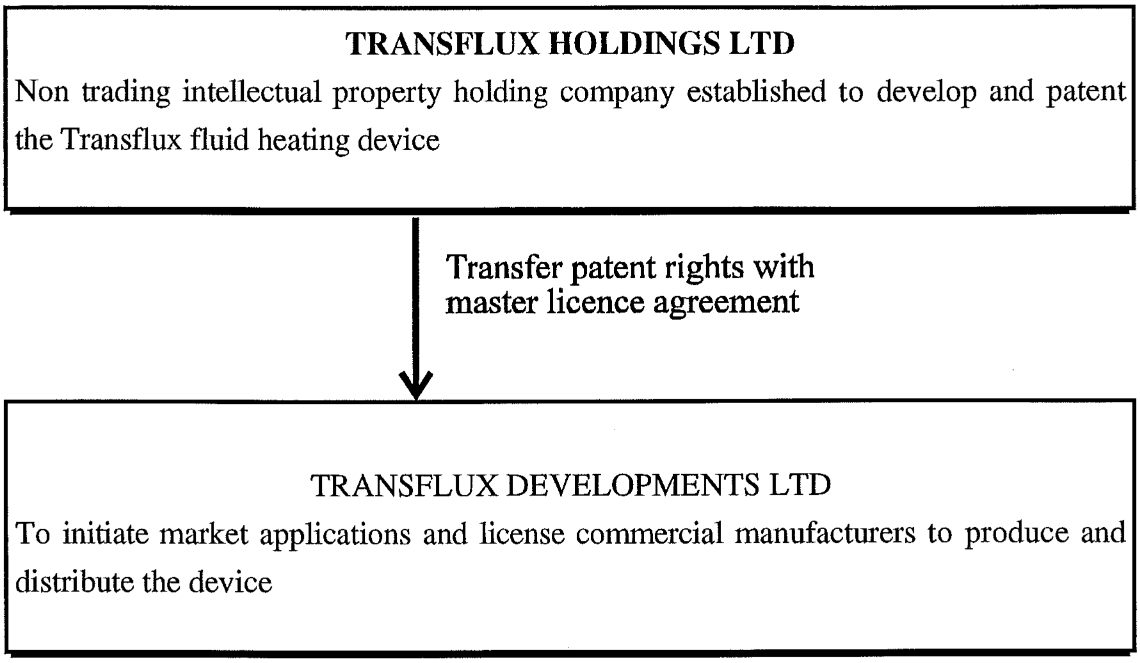

Fig 4.1 Present structure of Transflux Operation

4.2 Present company personnel

The board of Transflux Holdings comprises three representatives from Southpower. They are Mr Laurie, the Chief Executive Officer of Southpower, Mr Brendon Kearney the finance manager, and Mr Graham Hodge, the General Manager of Development and Research. The Development and Research department is responsible for looking into product research under which Transflux was initially funded.

The University of Canterbury is being represented by the Assistant Finance Registrar, Mr Goode.

The board also has Ross Walker as one of the directors. Ross as has already been mentioned is the inventor of the Transflux device. He has extensive technical experience in electrical engineering. Appendix 9 contains his curriculum vitae.

Dr Pat Bodger is another member of the Board of Directors of Transflux Holdings Ltd. He has been involved with the development of Transflux from inception. Appendix 10 contains his curriculum vitae.

The board is advised by Dennis Breese of Canterprise, which is the commercial arm of the university. Canterprise has been given the task of facilitating consultancy from university expertise to the external business environment and to guide new prototype developments into the commercial world. Canterprise is actively involved in seeking commercial support for the development of projects from prototype to manufacturing stage. Dennis has a background of assisting new technology start-ups. Dennis' curriculum vitae is in Appendix 11.

Transflux Developments has recently appointed Ian McInnes as general manager. He has extensive experience working for Aquatherm, a boiler manufacturer based in the North Island. He will be working closely with Dennis Breese to familiarise himself with what has been achieved up to his joining the company.

Transflux Developments has two other employees. They are Ross Walker and John Morris. Walker will further develop, continue research and assist in the manufacture of products. Morris has only been working for Transflux Developments for two months. His responsibilities include assisting Walker in building the units. Morris will also help in developing a control unit that will become an integral part of the Transflux device. He will work closely with research students who will be developing control systems for the Transflux. Morris has a lot of experience working with switch gear when he trained as an electrician. He has an Advanced Trade certificate and is a registered electrician. His curriculum vitae is in Appendix 12.

Dr Bodger acts as a consultant to Transflux Developments. He has developed a computer program to design heaters by inputting certain specifications that are obtained from customers. Appendix 13 shows the required specifications required by his program to design a heater.

Southpower has made available the services of two of their employees to Transflux Developments. Both employees are with Southpower Energy Services and are with the Design and Engineering section. They are Tony Somers who is the Design and Engineering manager, and Cory Franklin who is an engineering technician. The two Southpower employees are largely responsible for providing engineering service functions on behalf of Transflux Developments. They also assist in marketing the heater, by calling upon potential customers and explaining the principles of operation as well as benefits obtained by using the heater.

4.3 Future company structure

The future company composition will be the same for the holding company. The Holding company will license manufacturing rights to the development company for a period of six years (up to 1999). The holding company will still own the intellectual property rights of the heater. Royalty payments will be received from the development company. After 1999, a reassessment will be carried out to determine what to do with the patent rights.

Transflux Holdings has two options when it considers the future of its patent rights. These are :

- By assignment - Transflux Holdings can sell the patent to someone else by deed. By doing this the company relinquishes all its rights to the product and all rights will be transferred to the new owner. This option will be carefully considered before it is adopted.

- Licence agreement - Transflux Holdings will retain ownership of the intellectual property rights. It will issue a further licence to the Development company, or seek new licensees to manufacture and distribute the product. These companies will pay a royalty to Transflux Holdings Ltd. Transflux Holdings has the option of granting either an exclusive or a non-exclusive licence. A non-exclusive licence will be issued as the product has several applications and each application is usually being served by a different market. Granting a non-exclusive licence will facilitate better service in each market segment.

Appendix 14 gives a list of matters to be covered by Transflux Holdings when deciding to licence the product.

The composition of the development company will be different from the present company structure. At present Southpower owns 100% of the company. The pro-forma financial statements show that the present resources are inadequate to see the company through to 1999. New investors will be sought to take up shares in the company. Obtaining outside investors will also eliminate possibilities of conflicts of interests with Southpower.

The Development company will have a board of directors who will be responsible for establishing policies and goals. The general manager together with his team will be responsible for developing a strategy to translate goals into action.

4.4 Future company personnel

No addition will be made to the present staff structure in 1994. The two people involved on the technical side will be able to manufacture up to fifteen units in 1994. They will also have time to devote to research and development.

A mechanical/production engineer will be required in 1995 to help with the design of the steam units and also assist in fluid dynamics improvements. He will also assist in improving and refining the manufacturing process.

The general manager has experience in the boiler industry. He will perform both line functions (activities to achieve direct goals e.g. production and selling) as well as staff functions (activities to support line functions, e.g. finance, personnel, legal). The manager needs to have good communication skills and be patient as he is also managing research - an act of human creativity and perseverance.

He will be expected to foster informal communication at the operating level of the company and meetings will be held with all participants as a means of exchanging ideas.

During the first two years, no sales person will be required. The manager will carry out line functions. This includes selling and promotion. He will work closely with the people already involved from Southpower. A salesman will be needed after 1995 when the heater will be ready for distribution in the South Island. One salesman will be employed for this.

As the company grows in sales, another employee might be needed to assist in the production section. This is not expected until after 1996. This employee will be required to have experience in the following areas: electrical and mechanical construction, machining, maintenance and electrical registration. He/she will be expected to be self motivated and be able to integrate with a team of professional and technical staff.

Marketing research for the first three years will be carried out by future MEM students as part of their research project.

A salesman will be employed in the North Island in 1997. He will be responsible for initial marketing research in the North Island.

Dr Bodger will continue to act in a consulting role to Transflux Developments, together with Dennis Breese.

Table 4.1 Outlines the proposed staff requirements for Transflux Developments Ltd.

Year	Staff
1994	Ian McInnes Ross Walker John Morris Dr Bodger (Consulting) Dennis Breese (consulting)
1995	1994 Staff + Mechanical engineer
1996	1995 Staff + Salesman
1997	1996 Staff + Salesman + Technician
1998	1997 Staff
1999	1998 Staff

Table 4.1 Proposed staff for Transflux Developments

4.5 Availability of skilled labour

In 1994, a mechanical engineer will be needed to assist in research and production. Transflux Developments has the option of working closely with companies like Mercers Stainless Ltd and Burns and Farrell who already have expertise in steam and fluid dynamics. An amicable agreement could be concluded with them to obtain the services of a mechanical engineer. If all attempts at recruiting a mechanical engineer fails, it might be worthwhile to approach the Mechanical Engineering Department and work out something in the line of a research project for a masters student.

In both 1996 and 1997 the services of a salesperson will be required each year. A salesperson with some engineering background will be sought. With the introduction of an MEM program, engineering students will possess both technical and business abilities to be salesmen. MEM students will be given the opportunity to become engineering salespeople.

In 1997, a technician will be added on to the staff. A technician with mechanical skills will be employed. He will possess boiler welding certification. This will be the most difficult of appointments as few people with such qualifications are available. In the budget of 1993, the Government has decided to help companies train people as the future of the country lies in people acquiring the right skills. Boiler makers like Scotts Engineering are finding it difficult to get qualified people to manufacture boilers. However it is hoped that by 1997 this would have changed.

There will also be labour turnover within Transflux and from time to time staff will have to be recruited to replace leaving staff . It is hoped that very few problems will be encountered replacing staff.

4.6 Reward policies

Transflux developments seek certain kinds of behaviour in its employees such as competent individuals who agree to work with a high level of performance and loyalty. These employees will be accordingly rewarded. The employees, in exchange for their commitment expect both intrinsic and extrinsic benefits. Extrinsic rewards are in the form of their basic salary and intrinsic rewards include the feeling of competence, achievement, responsibility, significance, influence, personal growth and meaningful contribution.

Transflux Developments will place emphasis on extrinsic rewards as this will stimulate the employees to increase their commitment and develop their competence. Employees will be given independence to pursue areas they feel will contribute greatly in enhancing the present product.

The wages of all the employees (except the sales staff) will not be tied to performance. This will signal to the employees that each individual is given self-control. This will increase their feelings of competence and self determination.

Transflux Developments will offer some fringe benefits to motivate the employees to join the company. These fringe benefits will, however, not be used to motivate employee performance, since there is no linkage between performance and reward.

The fringe benefits to be offered over the next few years would be:

- Extra pay for time worked on holidays and weekends
- Bonuses at Christmas
- Payments for time not worked such as sick days and statutory holidays

Depending on company performance over the next five years, a further fringe benefit will be included in the package. This will be the payment for employee health and security such as health insurance.

A skill-performance based reward system will be used for the salespeople. Their salary will initially be based on their abilities. With the acquiring of new skills, their performance will improve and they will be accordingly rewarded. This will motivate and also help attract and keep achievement-oriented individuals. However, strict monitoring will be ensured to prevent the pushing of unwanted products to customers as this will damage the long-term customer relationship in particular and the company image in general. Transflux Developments will also ensure that salespeople do not take orders or make commitments that cannot be fulfilled by the company.

CHAPTER 5 - OPERATIONAL ANALYSIS

5.1 Production process

Building of a Transflux unit starts from the inside and working outwards. The innermost part of the unit is the jacket where the fluid flows out of the unit. This is a bar made of mild steel. The bar is insulated with fibre glass material.

The next production step is building up the primary winding of the unit. This is the simplest of all the processes. The windings are made of copper winding wire to minimise the resistance. The windings are separated from each other by using fibre glass rods to allow the flow of oil to coll the windings. A lathe is used in winding the coils. The primary winding is insulated from the secondary winding by a layer of fibre glass.

The next process is building up the secondary winding, which is made of copper tubing. The individual turns of the secondary are held to each other by using silicon neutral cure RTV and metal seal (RTV).

The double-wall shell (can) is currently being manufactured by Taylors Ltd, a Christchurch based boiler manufacturer. The design for this has come about by working closely with an engineer from the company.

The most difficult process of the entire manufacturing exercise is to assemble all the components. This is very labour intensive. With continuous research and development, it is hoped that the assembly process will be improved and made less labour intensive. This breakthrough will be necessary before mass production can begin.

5.2 Available facilities

Manufacturing takes place in the workshop of the Electrical and Electronic department of the University of Canterbury. All the facilities available belong to the University. The university is very happy to let Transflux Developments continue to use its facilities for its initial commercialisation effort.

The equipment presently being used by Transflux Developments include the following:

- Lathe - used for winding copper for both the secondary and primary windings. Also used for further expansion of the hole in the ASAD bar.

- Welding plant - used for welding together the various connections used throughout the unit. It is also used for welding parts together.

- Drill press - used for drilling holes.

- Hand tools - a wide variety of hand tools are used for various tasks.

These equipment have to be shared with other university staff who are going about normal university work.

The production costs associated with the Transflux unit are small when compared to the competition. This is due to the facilities being provided free by the university. The manufacturing process described is also quite simple and no sophisticated equipment is needed. Most other boiler manufacturers are going for sophisticated technology such as computer controlled plasma cutting equipment, CAD and other sophisticated design aids. ISO 9000 systems are also being introduced by the bigger boiler manufacturers. This significantly raises the production costs and the ultimate price of the boilers as the expenses incurred are passed on to the customer.

5.3 Production capacity

Appendix 8 gives a rough estimate of the amount of time spent on building five different units. If factors such as training new staff, confidence level of the staff, experience are taken into consideration, it will be correct to assume that 50% could be added to the present time to build units. This would mean that it would take about ten days to build a 50kW unit provided the necessary equipment is available.

The production process as already described is very labour intensive. After development Transflux will move from manufacturing to assembling and carrying out performance tests. The various modules will be subcontracted to companies in Christchurch. The modules will be manufactured by several different contractors. This will ensure that the true nature of the process is only known to the staff of Transflux Developments.

In future, it is hoped that a separate site might be obtained where the assembly process could be relocated. The necessary equipment and tools will be purchased to do the job.

5.4 Quality control

> *Quality is defined as conformance to customer needs through conceiving, designing and manufacturing and marketing products and services with superior performance and reliability.*— **Kodak Australia**.

Quality control will be strictly observed by Transflux Developments. Quality will be built into the process and the product will therefore be of an acceptable quality level.

The production process has already been described and there are a lot of connections to be made. Building quality into these processes will ensure that leakages and other associated problems are eliminated. Each employee will be responsible for inspecting the quality of their own work. The employees involved in the production process will use the Japanese concept of "Jidoka" - quality at source. This means that everything will be stopped when something goes wrong and production will not continue until the problem has been discovered and rectified.

Transflux Developments will put in place a Total Quality Management (TQM) program. Transflux Developments through TQM would seek continual improvement in the processes, goods and services of the company. This program will also focus on raising employee awareness of the following TQM goals.

- To provide product and service quality better than any competitors;
- To relentlessly pursue quality improvement;
- To personally involve all employees through participative activity;
- To be comprised of employees who approach the job fearlessly.

5.5 Raw material supplies and sources

The raw materials used in the manufacturing of the heater could be obtained from any electrical and plumbing stores. However, Transflux Developments will purchase material from stores that are known to provide materials of the required quality level that Transflux seeks.

Presently purchases are being made at stores close by, as small quantities are being purchased. With the expansion of operations, Transflux Developments will seek suppliers who are willing to offer reasonable prices and acceptable conditions of purchase. It will be extremely difficult to exert any amount of leverage on suppliers for the next two years. However it is hoped that by 1997, production will reach a level whereby some amount of leverage could be used on suppliers.

The double-walled shell is now being manufactured by Taylors Ltd. At present only one or two cans are ordered at a time. Obtaining an acceptable price is rather difficult. The can size is hoped to be standardised, an order of around ten cans will be placed. With such a large quantity being ordered, it is hoped that an agreement and an acceptable price to both parties could be reached. Transflux Developments will also approach other sheet metal shops to acquire quotations for the manufacture of the cans.

CHAPTER 6 - FINANCIAL ANALYSIS

6.1 Historical financial statements

Transflux Developments has only been operating for a year. Below is the financial statements for year ending 31 December 1993.

Data Used in Analysis:

	1993
Total materials	0
Total labour	0
Cost of goods sold (COGS)	0
Sales	0

Profit and Loss Statement:

Year	1993
Sales	0
COGS	0
GM	0
Operating Expenses:	
Sales & Marketing	10,000
R&D	50,000
G&A	30,000
Depreciation	0
Total Operating Expense	90,000
NBT	(90,000)
Tax	0
PAT	(90,000)

Cashflow Statement:

Year	1993
Cash from operating activities	
Cash from sales	0
Depreciation	0
cash disbursed	
Supplies	0
Employees	35,000
Other	55,000
Taxes paid	0
Total disbursed	90,000
Net Cash from operating activities	(90,000)
Cash from investing activities	
Purchase of assets	0
Sale of assets	0
Net cash from investing	0
Cash from financing activities	
Cash provided by issuance of stock	250,000
Cash from loan	0
Cash applied(dividend)	0
Net cash from financing	250,000
Cash brought forward	0
Accounts rec from previous year	
Accounts payable from previous year	0
Net cash	160,000

Balance Sheet:

Year	1993
Current Assets	
Accounts receivable	0
Cash	160,000
Total Current assets	160,000
Fixed Assets	
Property	0
Depreciation	0
Total Fixed assets	0
Total Assets	160,000
Liabilities	
Current Liabilities	0
Equity	
Shareholders funds	250,000
Retained Earnings	(90,000)
Total Liabilities and Equity	160,000
ROI	-56.25%

The financial statements show that at the end of 1993 Transflux Developments has a cash balance of $160,000 to see it through the ensuing years. No liabilities have been incurred in 1993. Appendix 15 gives the assumptions and proforma financial statements.

6.2 Capital required and its form

To undertake the marketing program that has been discussed, the proforma financial statements indicate that a further $375,000 will be needed. Transflux Developments need at least $75,000 in 1994 to be able to maintain its program of development. If this amount is not forthcoming, the company will run out of cash and it most likely will become insolvent. In 1995, $175,000 will be needed. Transflux Developments will be developing its units in these two years and it is hoped that a breakthrough in steam will have been achieved. Substantial amounts will be spent on research and development in these two years.

The South Island roll out is expected to start in 1996 and the amount spent on marketing will be significant. A further $75,000 will be needed to ensure the start of a smooth roll out. The North Island roll out will start in 1997 and $50,000 will be required.

Transflux intends to obtain the necessary funding by inviting potential investors to take up shares of Transflux Developments. Funds will be sought from sources other than Southpower. Transflux Developments will try to secure investments from companies that manufacture products that use boilers such as autoclaves and food processing equipment. Venture capital will also be sought. At present Southpower owns 100% of the company. The share capital is presently $250,000. It is hoped that the capital will increase to $625,000 by the year 1997. This will give Southpower a 40% stake in Transflux Developments and the 60% will be taken up by investors. It is hoped that more than one investor will take up the 60% of the company.

Transflux Developments will apply for a business development grant. The governments Business Development policy is aimed at assisting companies to identify and capitalise on their own opportunities for development. The objective of this programme is to encourage New Zealand businesses to become more innovative and internationally competitive. The grant provides up to $20,000 towards investigating the commercial feasibility and/or the technical viability of a company's activity.

The government also provides an Expert Assistance Grant Scheme. This scheme provides up to $8000 to engage consultants in key management areas, to assist start-up companies.

If these applications are successful, the business grant will be used to provide scholarships to electrical students to develop a control system. The expert grant will be used to carry out research in the North Island for the eventual roll out in 1997.

6.3 Risks

The following risks might affect Transflux Developments during its operations:

Production risks - Transflux Developments intends to practice some form of just-in-time production. There will be no inventory, thus increasing the return. However, there is a risk of not obtaining the materials needed when production is scheduled thus losing potential revenue.

Business risks - Changes in demand will cause variations in revenue from sale, and expected returns outlined in the financials might not be achieved. The component prices might alter the value of the cost of goods sold and thus the gross margin will be affected. A better product might be in the market within a few years which might render the Transflux obsolescent. Present boiler manufacturers might become more aggressive and try to put Transflux developments out of business.

Adoption rate risk - It is quite uncertain as to the number of food industries that will be willing to adopt the Transflux unit. Most industries depend entirely on the supply of hot water and steam and are unwilling to change from proven methods to new ones. The whole plan is based on a significant number of industries taking up the new technology. If this is not achieved then there is a likelihood of the business failing.

Financing risk - The program cannot be carried out without the injection of $375,000 over the next three years. If no money is forthcoming this year there would be an acute shortage of cash and the business will have to be liquidated. A critical stage has been reached and financiers are needed within the next three months to come up with at least $75,000.

People risks - There is a very loose management structure at present and this tends to lead to a breakdown in communication. This issue must be addressed immediately so that everyone is aware of what is going on. Over the next three years more people have to be recruited. The right persons must be employed or else there is a risk of wrong people taking the company into disrepute.

APPENDICES

Appendix 1

Manufacturers of boilers used in New Zealand

A & P
Abbot
Abron
Acme
Adamson
Allan
Aluminium Cooking Utensil Co
Am. Steriliser Co
Analis
Anchor
Anderson
Apac
Aquaheat
Armstrong
Arroll
Ass. Nazionale
Atco
Atherton
Autoclave
Negrs
Avelong/Porter
AW & F
Bagnal
Ballantyne
B & A (Bastion & Allen)
B & F (Burns & Farrell)
B & W (Babcock & Wilcox)
Baird & Tatlock
Baldwin
Banker & Bessemer
Barclay
Baring
Barry
Beeston
Berry
Boag
Bolton
BPD
Britannia
Braby
Brown & May
Buick
Burnside
Burrell
Burt
Burton
C & I
Cable
Calunghi
Cameron Bros
Cameron Saunders
Camptel
Castle
Canada Vulcanising Equip Co
S. Carves
CBC
CES
Controlled Flame boilers
Clare & warner
Clarkson
Clayton
Cimax
Cistern mauf Co
Cleaver Brook
Cochran
Collectramatic
Collet
Columbia
Combustion Eng
S. Compton
Concentramatic
Consul
Cradley
Crane
Cuddon
Cutler
C.W.F.
Danks

Danks & Netherton
Danor
Dispatch Eng
Dodman
Dri Kure
Dulton
Dunedin Engineering
Dye
Easton
EHS
Electrode Boilers
Farra
Fbs
Fletcher Bernard & smith
Foden
Fonlee
Foster, Yates & Thom
Foster Wheeler
Fowlers
Frasers
Gallenkamp
Galloway
Garrett
George George
Giovanna
Goodhead
Grantham
GWB Furnaces
Hamburg
Hamilton
Harris
Heatway
hedmora
Hurill
ICL
Ideal
Industrial Services
Jessep & Appleby
JM & B
J Johnston & Sons
Judd
Keeler
Kerrick
Kincaid
Kiwi Price Co
Kurt & kemann
Lyttelton Engineering
Luke
Lumbys
M.A.C.O.
McDonald
McGregor
J McGregor & Sons
McIntyres Clyde Iron Works
McKenzie & Ridley
McLaren
Mallet
Mannung & Warelle
Marshall Son & Baxter
Masefield
Mathews
Mason
Meisler
Mercer
Merrywether
Metatherm
Mirror Aluminium Co
Mitzui Shipbuilding Ltd
Monte
Morcan & Lable
murray
National Pressure Cooker
National Utitlities
N.D.A. (NE)
New Brunswick Scientific Co
New York press Machiner
Nippon
Niven
New Zealand Railways
North British Loco
Orr & Sembower
Parkinson Cowan
B Parker
Paxman
Peckett
Pearson
Pegg
Pegg Barrows (UK)
Penman
Perkins
Power Pac
Presha
Price Norsted
Ranson, Simms & Jefferies
Robertson
Robey
Robin Hood
Ruddich

Ruston
Sames Reuther
Scoth Marine
Scott
Seagar
SEC
Senior
Shales
Shand & Mason
Shanks
Sharman
Sherlock & Cotton
Siltex
Simons
Simons & Price
Sims
Sincro Engineering
Sittex Eng Steam Sterilizer
South Pacific Steam Co
S of E
Spark Hall
Sparrow
Spur Inman
Speedway
Spencer
Spencer Bonecart
Spencer Mopwood
Steadfast
Steam Generator
Steel Constrn
Sterimat
Stevenson
Stone
ST & S
Tangye
Tenjay
Thackery
A Thom
Thompson
Thorn
Thornton
Three star Engineering
Tomlinson
Topliss
Tosi
Trascott
Trehan
Trevor Bia
Vancouver Iron Works
Vaporax
Vekos
Verintron
Vsunski
Vulcan
Union Foundries
Wakefield
Wallis Stevens
Watson
Webco
Webecke
Wellington Forging Co
Westell
West Steel
Wiles Steel Structures
Wiles Cookers Australia
Woodleys
Wright & Boag
Wyngarrden
Yanagimoto

Source: B. Burton & L. Jackson "The New Zealand Boiler Stock" 1982

Appendix 2

Some product requirements

The heater has certain obligations under the Electricity Act 1992. This act requires the Transflux unit to be safe so as to cause no damage or injury to property or people. One acceptable solution to safety requirements is to meet the requirements of a listed standard. None exists for this product and hence the general requirements of NZS 6200:1988 - "*Specification for the general requirements for electrical apparatus and materials*" - are applicable.

If the Transflux unit is to be used for residential purposes, then it must comply with NZS 6335:1990 "*Approval and test specification - particular requirements for instantaneous water heater*". The unit must also have adequate radio and television interference suppression, this is specified in the CISPR (International Special Committee on Radio Interference) recommendations.

Appendix 3

Steam requirements

- The use of at least a 6mm steel plate (boiler certified steel) for the pressurised vessel.

- Approved drawings must be available of the design. These drawings cannot be altered in any way, not even in the position of a bolt.

- The welding of the pressurised vessel must follow certain specifications and properly qualified welders are to be used.

- There must be a pressure relief valve to release the pressure in case there is an excess build-up of pressure in the vessel.

Appendix 4

Two further applications

Baking Industry

A lot of steam is used in this industry. Steam is injected into the ovens for improving the baked appearance of the products.

Provers are used in the baking industry to raise the dough used in pastry and in bread. Since bakeries are involved in commercial production, time is very essential. The time taken for the dough to rise is reduced significantly if steam is passed over it. This has to be a very humid process and the humidity content in the provers could be as high as 90%.

There are a lot of small bakeries all over New Zealand. These bakeries would not be able to maintain oil fired boilers. Most small bakeries use electric boilers. Efficiency is very important and there is great potential for the use of the Transflux device.

Freezing works

In the freezing industry, huge amounts of hot water are used for various processes. Most of the equipment used have to be sterilised using hot water. The temperature of sterilisation is 82°C. There is the presence of blood on the factory floor and water at 60°C is used for cleaning down. The temperature of water for workers to wash their hands is 40°C. Freezing works in New Zealand are usually big complexes and some of the hot water is needed in some remote facilities where it is not possible to run a pipe from the central boiler room. The size of boiler needed for such facilities are in the range of 100-150kW units. Most freezing works have installed electrode boilers in their remote facilities. There exists an opportunity for the sale of Transflux units in this industry. A possible starting point could be Fortex Ltd. Fortex have been very innovative and it is quite likely that they will be interested in this innovative product.

Appendix 5

Brewing Industry

Two Breweries responded to the survey sent out. They all used two central boilers and steam was delivered through an intricate winding of pipes.

Brewery 1

Type	Steam	Steam
Fuel	Gas	Gas
Output rating	2MW	3MW
Max. Temp	178°C	178°C
Economical	No	No
Maintenance	Medium	Medium
Cost and installation	Very High	Very High
Running costs	Medium	Medium
Efficiency	70%	70%

Brewery 2

This brewery uses two of the same type of boilers.

Type	Steam
Fuel	Coal
Output rating	4MW
Max. Temp	200°C
Economical	No
Maintenance	Very High
Cost and installation	Very High
Running costs	Low
Efficiency	60%

Appendix 6

Canned Foods Industry

Two industries returned questionnaires. One used a central boiler for most of its applications and had steam piped through to the point of use. The other used several boilers depending on the requirements.

Central boiler

Type	Steam
Fuel	Oil
Output rating	1.1MW
Max. Temp	121°C
Economical	No
Maintenance	High
Cost and installation	Substantial
Running costs	High

Several boilers

Type	Hot Water	Steam	Fluid
Fuel	Gas	Gas	Electric
Output rating	600kW	100kW	20kW
Max. Temp	75°C	105°C	100°C
Economical	Yes	Yes	No
Maintenance	Low	Low	Low
Cost/installation	Substantial	$80,000	$5,000
Running costs	Medium	Medium	Medium

The factory had several of these boilers scattered around the entire plant.

Appendix 7

A mushroom dehydration plant was surveyed and an oil burner was being used. The engineer wasn't very clear about the ratings of the oil burner used in that particular plant or the other plants.

Southpower were asked to assist and a calculation was eventually done. The plant had a rating of 146kW. Typical oil burners are only around 50-60% efficient. Thus the effective rating of the dehydration plant was around 75kW.

APPENDIX 8

50kW unit forced oil

	units	unit price	total	sub totals
Can from Taylors	1.00	1,000.00	1,000.00	
3/8 automatic air vent	1.00	23.50	23.50	
Cork seal	1.00	10.00	10.00	1,033.50
Primary cores				
2.8 mm winding wire	22.50	11.00	247.50	
ASAD bar	9.60	6.25	60.00	
Brass nippling	1.00	12.24	12.24	
1/2 in compression fitting	6.00	2.26	13.56	
Fiber glass	1.00	10.00	10.00	
Insulation paper (nomex)	1.00	20.00	20.00	363.30
Secondary				
1/2 copper tubing (per coil)	1.50	94.36	141.54	
Brass nippling	0.50	12.24	6.12	
Silfos rod	0.20	6.71	1.34	
Silicon neutral cure RTV	0.50	12.00	6.00	
Metal seal (RTV)	0.50	12.00	6.00	
15 mm copper bends	6.00	2.12	12.72	
Fiber glass	2.00	10.00	20.00	
Insulation paper (nomex)	1.00	20.00	20.00	213.72
Secondary fixtures				
265 mm * 3 mm steel plate	1.00	12.00	12.00	
265 mm * 1 mm steel plate	1.00	6.00	6.00	
15 mm brass back nut	12.00	1.67	20.04	38.04
Unit connections to Can				
15 mm copper bends	6.00	2.12	12.72	
20 mm tees	2.00	4.16	8.32	
Silfos rod	0.20	6.71	1.34	
20 mm crox nut	2.00	1.44	2.88	
15 mm crox nut	6.00	0.98	5.88	
20 mm brass backnut	1.00	1.85	1.85	
15 mm brass backnut	1.00	1.67	1.67	
1 1/2 *3/4 galv bush	1.00	3.09	3.09	37.75
Electrical connection				
1/2 brass studs	2.00	12.00	24.00	
1/2 brass nuts	35.00	0.50	17.50	
1/2 brass washers	28.00	0.20	5.60	
2.8 mm sleeving	3.00	5.00	15.00	
Silfos rod	0.20	6.71	1.34	
265 mm * 5mm formica cover	1.00	30.00	30.00	
3/8 automatic air vent	1.00	23.50	23.50	

Air pressure switch	1.00	38.00	38.00	
6 core flex	1.00	4.00	4.00	
3core flex	1.00	4.00	4.00	
Stainless steel cover	1.00	50.00	50.00	
Rubber beading	1.00	4.00	4.00	
Rubber lid seal	1.00	20.00	20.00	
Thermistors	3.00	20.00	60.00	296.94
Auxiliary pump				
1/2 HP stainless steel motor	1.00	434.00	434.00	
40 mm barrel nipple	1.00	3.44	3.44	
25 mm barrel nipple	6.00	1.35	8.10	
25 mm blk wrgt elbow	5.00	2.55	12.75	
25 mm blk mal union mac f	1.00	23.45	23.45	
Heldite tape & hemp	1.00	10.00	10.00	491.74
Oil				
Mobil therm	1.80	48.00	86.40	86.40
Labour				
Jacket	8.00	14.42	115.36	
Primary winding	6.00	14.42	86.52	
Secondary winding	8.00	14.42	115.36	
Unit assembly	6.00	14.42	86.52	
Unit assembly into can	12.00	14.42	173.04	
Onsite inspection & assembly	8.00	14.42	115.36	692.16
	48 hours		Total	3253.56

UNIT PRICES for forced oil circulation	Labour		on cost 200.00%
50kW	48 hours	$3,254	$9,761
100kW	52 hours	$3,464	$10,391
150kW	56 hours	$4,502	$13,507
200kW	58 hours	$4,895	$14,684
250kW	62 hours	$5,290	$15,869

100kW unit forced oil

	units	unit price	total	sub totals
Can from Taylors	1.00	1,000.00	1,000.00	
3/8 automatic air vent	1.00	23.50	23.50	
Cork seal	1.00	10.00	10.00	1,033.50
Primary cores				
3.5 mm winding wire	32.00	11.00	352.00	
ASAD bar	12.00	6.25	75.00	
Brass nippling	1.00	12.24	12.24	
1/2 in compression fitting	6.00	2.26	13.56	
Fiber glass	1.00	10.00	10.00	
Insulation paper	1.00	20.00	20.00	482.80
Secondary				
1/2 copper tubing	2.00	94.36	188.72	
Brass nippling	0.50	12.24	6.12	
Silfos rod	0.20	6.71	1.34	
Silicon neutral cure RTV	0.50	12.00	6.00	
Metal seal	0.50	12.00	6.00	
15 mm copper bends	6.00	2.12	12.72	
Fiber glass	2.00	10.00	20.00	
Insulation paper	1.00	20.00	20.00	260.90
Secondary fixtures				
265 mm * 3 mm steal plate	1.00	12.00	12.00	
265 mm * 1 mm steal plate	1.00	6.00	6.00	
15 mm brass back nut	12.00	1.67	20.04	38.04
Unit connections to Can				
15 mm copper bends	6.00	2.12	12.72	
20 mm tees	2.00	4.16	8.32	
Silfos rod	0.20	6.71	1.34	
20 mm crox nut	2.00	1.44	2.88	
15 mm crox nut	6.00	0.98	5.88	
20 mm brass backnut	1.00	1.85	1.85	
15 mm brass backnut	1.00	1.67	1.67	
1 1/2 *3/4 galv bush	1.00	3.09	3.09	37.75
Electrical connection				
1/2 brass studs	2.00	12.00	24.00	
1/2 brass nuts	35.00	0.50	17.50	
1/2 brass washers	28.00	0.20	5.60	
2.8 mm sleeving	3.00	5.00	15.00	
Silfos rod	0.20	6.71	1.34	
265 mm formica cover	1.00	30.00	30.00	
3/8 automatic air vent	1.00	23.50	23.50	
Air pressure switch	1.00	38.00	38.00	
6 core flex	1.00	4.00	4.00	
3core flex	1.00	4.00	4.00	
Stainless steal cover	1.00	50.00	50.00	

Rubber beading	1.00	4.00	4.00	
Rubber lid seal	1.00	20.00	20.00	
Thermistors	3.00	20.00	60.00	296.94
Auxiliary pump				
1/2 HP stainless steal motor	1.00	434.00	434.00	
40 mm barrel nipple	1.00	3.44	3.44	
25 mm barrel nipple	6.00	1.35	8.10	
25 mm blk wrgt elbow	5.00	2.55	12.75	
25 mm blk mal union mac f	1.00	23.45	23.45	
Heldite tape & hemp	1.00	10.00	10.00	491.74
Oil				
Mobal therm	1.50	48.00	72.00	72.00
Labour				
Jacket	8.00	14.42	115.36	
Primary winding	6.00	14.42	85.52	
Secondary winding	8.00	14.42	115.36	
Unit assembly	8.00	14.42	115.36	
Unit assembly into can	14.00	14.42	201.88	
Onsite inspection & assembly	8.00	14.42	115.36	749.84
	52 hours		Total	3,463.52

150kW unit forced oil

	units	unit price	total	sub totals
Can from Taylors	1.00	1,800.00	1,800.00	
3/8 automatic air vent	1.00	23.50	23.50	
Cork seal	1.00	10.00	10.00	1,833.50
Primary cores				
2.8 mm winding wire	39.85	11.00	438.35	
ASAD bar	15.00	6.25	93.75	
Brass nippling	1.00	12.24	12.24	
1/2 in compression fitting	6.00	2.26	13.56	
Fiber glass	1.00	10.00	10.00	
Insulation paper (nomex)	1.00	20.00	20.00	587.90
Secondary				
1/2 copper tubing (per coil)	2.00	94.36	188.72	
Brass nippling	0.50	12.24	6.12	
Silfos rod	0.20	6.71	1.34	
Silicon neutral cure RTV	0.50	12.00	6.00	
Metal seal (RTV)	0.50	12.00	6.00	
15 mm copper bends	6.00	2.12	12.72	
Fiber glass	2.00	10.00	20.00	
Insulation paper (nomex)	1.00	20.00	20.00	260.90
Secondary fixtures				
265 mm * 3 mm steal plate	1.00	24.00	24.00	
265 mm * 1 mm steal plate	1.00	12.00	12.00	
15 mm brass back nut	12.00	1.67	20.04	56.04
Unit connections to Can				
15 mm copper bends	6.00	2.12	12.72	
20 mm tees	2.00	4.16	8.32	
Silfos rod	0.20	6.71	1.34	
20 mm crox nut	2.00	1.44	2.88	
15 mm crox nut	6.00	0.98	5.88	
20 mm brass backnut	1.00	1.85	1.85	
15 mm brass backnut	1.00	1.67	1.67	
1 1/2 *3/4 galv bush	1.00	3.09	3.09	37.75
Electrical connection				
1/2 brass studs	2.00	12.00	24.00	
1/2 brass nuts	35.00	0.50	17.50	
1/2 brass washers	28.00	0.20	5.60	
2.8 mm sleeving	3.00	5.00	15.00	
Silfos rod	0.20	6.71	1.34	
265 mm * 5mm formica cover	1.00	40.00	40.00	
3/8 automatic air vent	1.00	23.50	23.50	
Air pressure switch	1.00	38.00	38.00	
6 core flex	1.00	4.00	4.00	
3core flex	1.00	4.00	4.00	

Stainless steal cover	1.00	50.00	50.00	
Rubber beading	1.00	4.00	4.00	
Rubber lid seal	1.00	20.00	20.00	
Thermistors	3.00	20.00	60.00	306.94
Auxiliary pump				
1/2 HP stainless steal motor	1.00	434.00	434.00	
40 mm barrel nipple	1.00	3.44	3.44	
25 mm barrel nipple	6.00	1.35	8.10	
25 mm blk wrgt elbow	5.00	2.55	12.75	
25 mm blk mal union mac f	1.00	23.45	23.45	
Heldite tape & hemp	1.00	10.00	10.00	491.74
Oil				
Mobil therm	2.50	48.00	120.00	120.00
Labour				
Jacket	8.00	14.42	115.36	
Primary winding	8.00	14.42	115.36	
Secondary winding	8.00	14.42	115.36	
Unit assembly	10.00	14.42	1144.20	
Unit assembly into can	14.00	14.42	201.88	
Onsite inspection & assembly	8.00	14.42	115.36	807.52
	56 hours		Total	4,502.30

200kW unit forced oil

	units	unit price	total	sub totals
Can from Taylors	1.00	1,800.00	1,800.00	
3/8 automatic air vent	1.00	23.50	23.50	
Cork seal	1.00	10.00	10.00	1,833.50
Primary cores				
4.5 mm winding wire	54.00	11.00	594.00	
ASAD bar	20.00	6.25	125.00	
Brass nippling	1.00	12.24	12.24	
1/2 in compression fitting	6.00	2.26	13.56	
Fiber glass	1.00	10.00	10.00	
Insulation paper	1.00	20.00	20.00	774.80
Secondary				
1/2 copper tubing	4.00	94.36	377.44	
Brass nippling	0.50	12.24	6.12	
Silfos rod	0.20	6.71	1.34	
Silicon neutral cure RTV	0.50	12.00	6.00	
Metal seal	0.50	12.00	6.00	
15 mm copper bends	6.00	2.12	12.72	
Fiber glass	2.00	10.00	20.00	
Insulation paper	1.00	20.00	20.00	449.62
Secondary fixtures				
500 mm * 3 mm steal plate	1.00	24.00	24.00	
500 mm * 3 mm steal plate	1.00	24.00	24.00	
15 mm brass back nut	12.00	1.67	20.04	68.04
Unit connections to Can				
15 mm copper bends	6.00	2.12	12.72	
20 mm tees	2.00	4.16	8.32	
Silfos rod	0.20	6.71	1.34	
20 mm crox nut	2.00	1.44	2.88	
15 mm crox nut	6.00	0.98	5.88	
20 mm brass backnut	1.00	1.85	1.85	
15 mm brass backnut	1.00	1.67	1.67	
1 1/2 *3/4 galv bush	1.00	3.09	3.09	37.75
Electrical connection				
1/2 brass studs	2.00	12.00	24.00	
1/2 brass nuts	35.00	0.50	17.50	
1/2 brass washers	28.00	0.20	5.60	
2.8 mm sleeving	3.00	5.00	15.00	
Silfos rod	0.20	6.71	1.34	
500 mm formica cover	1.00	40.00	40.00	
3/8 automatic air vent	1.00	23.50	23.50	
Air pressure switch	1.00	38.00	38.00	
6 core flex	1.00	4.00	4.00	
3core flex	1.00	4.00	4.00	

Stainless steal cover	1.00	50.00	50.00	
Rubber beading	1.00	4.00	4.00	
Rubber lid seal	1.00	20.00	20.00	
Thermistors	3.00	20.00	60.00	306.94
Auxiliary pump				
1/2 HP stainless steal motor	1.00	434.00	434.00	
40 mm barrel nipple	1.00	3.44	3.44	
25 mm barrel nipple	6.00	1.35	8.10	
25 mm blk wrgt elbow	5.00	2.55	12.75	
25 mm blk mal union mac f	1.00	23.45	23.45	
Heldite tape & hemp	1.00	10.00	10.00	491.74
Oil				
Mobil therm	2.00	48.00	96.00	96.00
Labour				
Jacket	8.00	14.42	115.36	
Primary winding	8.00	14.42	115.36	
Secondary winding	8.00	14.42	115.36	
Unit assembly	10.00	14.42	144.20	
Unit assembly into can	16.00	14.42	230.72	
Onsite inspection & assembly	8.00	14.42	115.36	836.36
	58 hours		Total	4,894.76

250kW unit forced oil

	units	unit price	total	sub totals
Can from Taylors	1.00	1,800.00	1,800.00	
3/8 automatic air vent	1.00	23.50	23.50	
Cork seal	1.00	10.00	10.00	1,833.50
Primary cores				
4.5 mm winding wire	60.00	11.00	660.00	
ASAD bar	25.00	6.25	156.25	
Brass nippling	1.00	24.00	24.00	
1/2 in compression fitting	6.00	2.26	13.56	
Fibber glass	1.00	10.00	10.00	
Insulation paper	1.00	24.00	24.00	887.81
Secondary				
1/2 copper tubing	6.00	94.36	566.16	
Brass nippling	0.50	24.00	12.00	
Silfos rod	0.20	6.71	1.34	
Silicon neutral cure RTV	0.50	12.00	6.00	
Metal seal	0.50	12.00	6.00	
15 mm copper bends	6.00	2.12	12.72	
Fibber glass	2.00	10.00	20.00	
Insulation paper	1.00	20.00	20.00	644.22
Secondary fixtures				
500 mm * 3 mm steal plate	1.00	24.00	24.00	
500 mm * 3 mm steal plate	1.00	24.00	24.00	
15 mm brass back nut	12.00	1.67	20.04	68.04
Unit connections to Can				
15 mm copper bends	6.00	4.00	24.00	
20 mm tees	2.00	8.00	16.00	
Silfos rod	0.20	6.71	1.34	
20 mm crox nut	2.00	3.00	6.00	
15 mm crox nut	6.00	2.00	12.00	
20 mm brass backnut	1.00	3.00	3.00	
15 mm brass backnut	1.00	2.00	2.00	
1 1/2 *3/4 galv bush	1.00	3.09	3.09	67.43
Electrical connection				
1/2 brass studs	2.00	12.00	24.00	
1/2 brass nuts	35.00	0.50	17.50	
1/2 brass washers	28.00	0.20	5.60	
2.8 mm sleeving	3.00	5.00	15.00	
Silfos rod	0.20	6.71	1.34	
500 mm formica cover	1.00	40.00	40.00	
3/8 automatic air vent	1.00	23.50	23.50	
Air pressure switch	1.00	38.00	38.00	
6 core flex	1.00	4.00	4.00	
3core flex	1.00	4.00	4.00	

Stainless steal cover	1.00	50.00	50.00	
Rubber beading	1.00	4.00	4.00	
Rubber lid seal	1.00	20.00	20.00	
Thermistors	3.00	20.00	60.00	306.94
Auxiliary pump				
1/2 HP stainless steal motor	1.00	434.00	434.00	
40 mm barrel nipple	1.00	3.44	3.44	
25 mm barrel nipple	6.00	1.35	8.10	
25 mm blk wrgt elbow	5.00	2.55	12.75	
25 mm blk mal union mac f	1.00	23.45	23.45	
Heldite tape & hemp	1.00	10.00	10.00	491.74
Oil				
Mobil therm	2.00	48.00	96.00	96.00
Labour				
Jacket	8.00	14.42	115.36	
Primary winding	8.00	14.42	115.36	
Secondary winding	8.00	14.42	115.36	
Unit assembly	10.00	14.42	144.20	
Unit assembly into can	16.00	14.42	230.72	
Onsite inspection & assembly	12.00	14.42	173.04	894.04
	62 hours		Total	5,289.73

Appendix 9

CURRICULUM VITAE

NAME:	Ross Joseph Harold WALKER
ADDRESS:	102 Barrington Street Christchurch
TELEPHONE:	(03) 326-733 (Private) (03) 3667001 Ext 7100 (Business)
DATE OF BIRTH:	9 February 1954
MARITAL STATUS:	Married with 2 children aged 14 and 12
LEISURE ACTIVITIES:	Rafting
EDUCATION:	Papanui High School School Certificate in 4 subjects Electrical Qualifications Electrical Registration 1974 Advanced Trade Certificate 1982 New Zealand Certificate of Electrical Engineering 1986 BE Electrical Engineering, University of Canterbury 1988

EMPLOYMENT HISTORY:-

Company:	Southpower
Position:	Pricing Analyst
Period:	December 1989- January 1991

Company:	Municipal Electricity Department
Position:	Engineering Assistant
Period:	February 1986- December 1989

Company:	Municipal Electricity Department
Position:	Assistant Cable Foreperson (Packe Street)
Period:	March 1985- February 1986
Reason for leaving:	To study full time at University

Company:	Municipal Electricity Department
Position:	Foreman Wiring Department
Period:	September 1984- March 1985

Company:	Municipal Electricity Department
Position:	Acting Estimator Wiring Department
Period:	April 1984- September 1984

Company:	Municipal Electricity Department
Position:	Electrician Wiring Department
Period:	April 1981- April 1984

Company:	Central Canterbury Electric Power Board
Position:	Faultman
Period:	October 1977- April 1981
Duties:	Routine domestic repairs in consumers properties; special meter readings; responsible for stock of equipment in vehicle; switching on 33kV, 11kV and 400 V systems.
Reason for leaving:	To further educational studies

Company:	Lincoln College
Position:	Maintenance Electrician
Period:	March 1975- October 1977
Reason for leaving:	A better position was offered

Company:	Municipal Electricity Department
Position:	Apprentice Electrician
Period:	1970-1974

Appendix 10

CURRICULUM VITAE

Name:	Patrick Bodger
Qualifications:	B.E (Hons), Ph.D., P.Eng
Current Position:	Senior Lecturer Electrical and Electronic Engineering University of Canterbury
Referred Publications:	35
Book Publications:	1
Patent Publications:	2

Interests:

Advanced Analysis of power systems:
Analytical software for estimating the status of system operation. This includes powerflow, harmonics, new measures for assisting the interfering effect of power systems on communication networks and electromagnetic transients.

Human energy patterns:
Research in the evaluation of energy use in human society and its prediction. Modelling perceptions have allowed prediction of patterns of electrical energy consumption, industrial production, primary energy market shares and investment in energy industries.

Electrobiotechnology:
Research in the application of electromagnetic signals in biotechnology.

Technical Inventions:
Supervision of inventive technical design. Patent filing for water heater and electrical sterilisation of water.

Contract research and consulting:
Projects developing equipment for the live-line maintenance and quality assurance programme within the electrical industry. Extensive use of the High Voltage Laboratory has been made for testing for clients.

Industrial Experience:

Assistant Engineer:-	NZ Electricity Design and Construction, Power Station Maintenance 1977-1979
Engineer:-	NZ Electricity (Commercial Section) 1981

Appendix 11

CURRICULUM VITAE

NAME:	Denis Graham Breese
ADDRESS:	19 Cannon Hill Crescent Christchurch
EDUCATION:	University of Otago 1965-1967 Studied Business Management
EMPLOYMENT HISTORY:	
	Position Held
Christchurch Star 1976-1982	Promotions Manager Designed projects to increase circulation and advertising of "The Star"
Linc Development Centre 1982-1989	Marketing and Public Affairs Director Establishing marketing policy
Cardinal Network 1987-1989	Marketing Director Initiated Business Plan
Canterbury Technology Park 1986-1989	Chairman of the Board Researched concept of a Technology Park

Appendix 12

CURRICULUM VITAE

NAME :	John Herbert Morris
ADDRESS:	6 Longmuir Street Avonhead, Christchurch
EDUCATION:	
1991-Current	University of Canterbury Currently pursuing a Science Degree
1983-1986 Qualification obtained:	Christchurch Polytechnic Trade Certificate Electrical Advanced Trade Certificate (Electronics)
1979-1982	Cashmere High School
WORK EXPERIENCE:	Position held:
December 1992-February 1993 BREMCA INDUSTRIES LTD	Project Manager - contract Responsibility of the tendering design and organisation of switchgear contracts
November 1991 STREAT ELECTRICAL LTD	Electrician - contract Worked on heavy industrial and instrumentation wiring of a fellmongery
October 1991-November 1991 E. W. SMITH ELECTRICAL LTD	Electrician - contract Fitting-off the new EEE building University of Canterbury
May 1983 - January 1991 BREMCA INDUSTRIES LTD	Designer/Project Manager (May1987 - January 1991) Responsible for designing and preparing estimates Apprentice/Trade Electrician (May 1983 - May 1987) Apprentice Electrician on floor

Appendix 13

TRANSFLUX HEATER SPECIFICATIONS

Please fill in as many of the details below as you are able. Default values will be used for any entry not completed. The temperature and flow rate information will mostly determine the power rating of the device. Advice can be obtained on the preferred voltage, the number of phases and their connection to minimise costs for any power requirement.

Supply frequency	(50, 60Hz):
Supply voltage	(110, 230,400V):
Number of phases	(1,3):
Phase connection	(star, delta):
Fluid type	(eg. water):
Fluid flow rate	(l/min):
Fluid specific heat (water = 4180)	(J/kg/^{o}C)):
Fluid density (water = 995)	(kg/m^3):
Fluid inlet temperature	(^{o}C)
Fluid outlet temperature	(^{o}C):

Appendix 14

MATTERS TO BE COVERED IN DISCUSSION ON PROPOSED LICENCE TO MANUFACTURE A PATENTED ARTICLE

1. Whether licence is to be exclusive or non-exclusive. (Note - an exclusive licence gives the licensee the sole right to manufacture the patented invention within a particular country or area, to the exclusion of all others, including the patentee).

2. Consideration for which licence is granted:- e.g.
   (a) Fixed annual rental; or
   (b) Royalty on sales (usually 5% to 15% of licensee's selling price)

3. Additional consideration for exclusive licence:- e.g.
   (a) Premium of $ payable on execution of contract; or
   (b) Minimum annual royalty stipulated (usually about 50% of anticipated royalties payable on sales in an average year); or
   (c) Provision that licence shall become non-exclusive if minimum royalties of $ per annum not paid.

4. Period of licence:-
   (a) For full term of patent; or
   (b) For some lesser period - e.g. 3 or 5 years, with or without right of renewal.

5. Frequency of royalty payments - e.g. monthly, quarterly, annually, period of grace to be allowed for payment - one or two months.

6. Proper accounts and records to be kept by licensee. Statements of sales to accompany royalty payments. Provision for inspection and audit.

7. Whether licensee to have power to sub-licence manufacture in other centres. If so, usual provisions for approval by patentee, indemnity by head licensee in case of default in royalty payments by sub-licensee; sub-licensee to enter into covenants with patentee to observe same obligations as those of head licensee.

8. Improvements made by either party to be communicated to the other. Whether improvements are patentable - and by whom.

9. Infringements to be notified by each party to the other. Whose responsibility to proceed against infringers? Suggest:-
   (a) Each party to have the right to decline by notice to the other party.
   (b) If such notice is given, declining party is indemnified by the other party against all costs, arising from any action for infringement taken by the other party. Party taking action retains whole of any damages recovered, and pays all costs.
   (c) If no such notice is given, both parties are to join in instituting proceedings against infringer (if such action is desired by either party). Costs and damages to be shared equally.

10. Renewal fees on patent - Usually responsibility of patentee. Licensee entitled to inspect receipts, and to make payment and deduct from royalties in case of default by patentee.

11. Patentee to meet all costs of obtaining patent (if not yet obtained)

12. Marking of articles with patent number in prescribed manner to be responsibility of licensee.

13. Provision for cancellation of licence on breach.

14. Legal costs, fees and any duty on preparation of licence agreement - usually borne by licensee, but may be shared, or borne by patentee, as may be agreed

15. Any other special terms. (Note - a formal licence agreement usually includes a number of additional clauses, about which there is not usually any difference of opinion - e.g. undertaking by licensee to use best endeavours to exploit licence; undertaking by patentee to use best endeavours to obtain patent, etc.)

16. If patent has not yet been granted, and is refused for any reason, licence agreement may:-
    - (a) Terminate on final refusal of patent;
    - (b) Continue on basis of information and know-how supplied by inventor.

Source: P.L. BERRY & ASSOCIATES
PATENT ATTORNEYS

Appendix 15

Assumptions by market and unit size

1994

Market	Brewing	Ham	Can	Mushroom	dairy
Unit size (kW)	50	50	100	100	50
No. of units	2	1	1	1	2
Materials	2562	2562	2714	2714	2562
Labour	692	692	750	750	692
Total cost ($)	6508	3254	3464	3464	6508

Total materials	18238
Total labour	4960
COGS ($)	23,198

1995

Market	Brewing	Ham	Can	Mushroom	dairy
Unit size (kW)	50kW	50kW	50kW	100kW	50kW
No. of units	3	2	2	1	4
Materials	2562	2562	2562	2714	2562
Labour	692	692	692	750	692
unit size (kW)	100kW	100kW	100kW	150kW	150kW
No. of units	2	1	1	1	2
Materials	2714	2714	2714	3694	3694
Labour	750	750	750	808	808
Total cost ($)	16690	9972	9972	7966	22020

Total materials	52,834
Total labour	13786
COGS ($)	66,620

1996

Unit size(kW)	50	100	150	200
No. of units	14	9	5	3
Materials	2562	2714	3694	4059
Labour	692	750	808	836
Total cost	45,556	31,176	22,510	14,685

Total materials	90941
Total labour	22986
COGS ($)	113,927

1997

Unit size(kW)	50	100	150	200
No. of units	20	14	10	5
Materials	2562	2714	3694	4059
Labour	692	750	808	836
Total cost ($)	65,080	48,496	45,020	24,475

Total materials	146471
Total labour	36600
COGS ($)	183,071

1998

Unit size(kW)	50	100	150	200	250
No. of units	25	17	13	7	3
Materials	2562	2714	3694	4059	4396
Labour	692	750	808	836	894
Total cost ($)	81,350	58,888	58,526	34,265	15,870
Total materials	199811				
Total labour	49088				
COGS ($)	248,899				

1999

Unit size(kW)	50	100	150	200	250
No. of units	35	25	20	15	10
Materials	2562	2714	3694	4059	4396
Labour	692	750	808	836	894
Total cost ($)	113,890	86,600	90,040	73,425	52,900
Total materials	336245				
Total labour ($)	80610				
COGS ($)	416,855				

Financial Assumptions

Depreciation - The assets of Transflux Developments has been depreciated over four years. A straight line method of depreciation is used with no residual value.

Sales - The sales figures have been arrived by looking at competitor pricing and also the perceived value of the product (using the perceptual maps). The following prices were used.

Unit size (kW)	Price ($)
50	7500
100	10,000
150	12,250
200	14,750
250	18,000

During the first two years when development sites are being set up a discount is given to customers.

Unit size (kW)	Discount ($)	Selling price ($)
50	1500	6000
100	2000	8000
150	2250	10000

Accounts receivable - This has been taken as 10% of sales.

Accounts payable - This is 25% of the material cost

Dividend - The dividend payout is 15% of the profit after tax.

Profit and Loss Statement:

Year	1993	1994 1st Qtr	1994 2nd Qtr	1994 3rd Qtr	1994 4th Qtr	1994
Sales	0	10,000	15,000	10,000	22,500	57,500
Discounts		2000	3000	2000	4500	11,500
Net sales		8,000	12,000	8,000	18,000	46,000
COGS	0	3,464	6,508	3,464	9,762	23,198
GM	0	4,536	5,492	4,536	8,238	22,802
Operating Expenses:						
Sales & Marketing	10,000	3,750	3,750	3,750	3,750	15,000
R&D	50,000	22,500	22,500	22,500	22,500	90,000
G&A	30,000	17,500	17,500	17,500	17,500	70,000
Depreciation	0	2,100	2,100	2,100	2,100	8,400
Total Operating Expense	90,000	45,850	45,850	45,850	45,850	183,400
NBT	(90,000)	(41,314)	(40,358)	(41,314)	(37,612)	(160,598)
Tax	0	0	0	0	0	
PAT	(90,000)	(41,314)	(40,358)	(41,314)	(37,612)	(160,598)

Profit and Loss Statement:

Year	1995 1st Qtr	1995 2nd Qtr	1995 3rd Qtr	1995 4th Qtr	1995	1996	1997	1998	1999
Sales	50,000	30,000	36,750	52,500	169,250	300,500	486,250	674,000	1,158,750
Discounts	10000	6000	6750	10500	33,250	0	0	0	0
Net sales	40,000	24,000	30,000	42,000	136,000	300,500	486,250	674,000	1,158,750
COGS	17,320	13,016	13,506	22,778	66,620	113,927	183,071	248,899	416,855
GM	22,680	10,984	16,494	19,222	69,380	186,573	303,179	425,101	741,895
Operating Expenses:									
Sales & Marketing	5,000	5,000	5,000	5,000	20,000	45,000	67,500	90000	125000
R&D	25,000	25,000	25,000	25,000	100,000	100,000	100,000	100000	100000
G&A	17,500	17,500	17,500	17,500	70,000	75,000	95,000	115000	125000
Depreciation	2,100	2,100	2,100	2,100	8,400	11,100	13,800	13800	6600
Total Operating Expense	49,600	49,600	49,600	49,600	198,400	231,100	276,300	318,800	356,600
NBT	(26,920)	(38,616)	(33,106)	(30,378)	(129,020)	(44,527)	26,879	106,301	385,295
Tax	0	0	0	0	0	0	0	0	31,129
PAT	(26,920)	(38,616)	(33,106)	(30,378)	(129,020)	(44,527)	26,879	106,301	354,166

Cashflow Statement:

Year	1993	1994 1st Qtr	1994 2nd Qtr	1994 3rd Qtr	1994 4th Qtr	1994
Cash from operating activities						
Cash from sales	0	7,200	10,800	7,200	16,200	41,400
Depreciation	0	2,100	2,100	2,100	2,100	8,400
cash disbursed						
Supplies	0	2,036	3,843	2,036	5,765	13,679
employees	35,000	31,000	31,000	31,000	31,000	124,000
Other	55,000	15,600	16,234	15,600	16,926	64,360
Taxes paid	0	0	0	0	0	0
total disbursed	90,000	48,636	51,077	48,636	53,691	202,039
Net Cash from operating activities	(90,000)	(39,336)	(38,177)	(39,336)	(35,391)	(152,239)
Cash from investing activities						
Purchase of assets	0	42,000	0	0	0	42,000
Sale of assets	0	0	0	0	0	0
Net Cash from investing	0	(42,000)	0	0	0	(42,000)
Cash from financing activities						
Cash provided by issuance of stock	250,000	0	0	25,000	50,000	75,000
cash applied(dividend)	0					
net cash from financing	250,000	0	0	25,000	50,000	75,000
Cash brought forward	0	160,000	78,665	40,609	26,193	160,000
accounts rec from previous year/qtr		0	800	1,200	800	0
accounts payable from previous year	0	0	679	1,281	679	0
Net cash	160,000	78,665	40,609	26,193	40,924	40,924

Cashflow Statement:

Year	1995 1st Qtr	1995 2nd Qtr	1995 3rd Qtr	1995 4th Qtr	1995	1996	1997	1998	1999
Cash from operating activities									
Cash from sales	36,000	21,600	27,000	37,800	122,400	270,450	437,625	606,600	1,042,875
Depreciation	2,100	2,100	2,100	2,100	8,400	11,100	13,800	13,800	6,600
cash disbursed									
Supplies	10,178	7,686	8,312	13,451	39,626	68,206	109,853	149,858	252,184
employees	39,750	39,750	39,750	39,750	159,000	196,500	251,500	270000	270000
Other	13,600	12,618	12,274	14,694	53,186	57,586	61,400	97,888	167,210
Taxes paid	0	0	0	0	0	0	0	0	31,129
total disbursed	63,528	60,054	60,336	67,895	251,812	322,292	422,753	517,746	720,523
Net Cash from operating activities	(25,428)	(36,354)	(31,236)	(27,995)	(121,012)	(40,742)	28,672	102,654	328,952
Cash from investing activities									
Purchase of assets	0	0	0	0	0	13,500	13,500	0	0
Sale of assets	0	0	0	0	0	0	0	0	0
Net Cash from Investing	0	0	0	0	0	(13,500)	(13,500)	0	0
Cash from financing activities									
Cash provided by issuance of stock	25000	75,000	0	75,000	175,000	75,000	50,000	0	0
cash applied(dividend)								0	53125
net cash from financing	25,000	75,000	0	75,000	175,000	75,000	50,000	0	(53,125)
Cash brought forward	40,924	40,375	79,628	48,231	40,924	95,466	115,940	188,427	303,088
accounts rec from previous year/qtr	1,800	4,000	2,400	3,000	1,800	4,200	30,050	48,625	67,400
accounts payable from previous year	1,922	3,393	2,562	2,771	1,922	4,484	22,735	36,618	49,953
Net cash	40,375	79,628	48,231	95,466	95,466	115,940	188,427	303,088	596,362

Balance Sheet:

		1993	1994 1st Qtr	1994 2nd Qtr	1994 3rd Qtr	1994 4th Qtr	1994
Current Assets							
	accounts receivable	0	800	1,200	800	1,800	1,800
	Cash	160,000	78,665	40,609	26,193	40,924	40,924
Total Current assets		160,000	79,465	41,809	26,993	42,724	42,724
Fixed Assets							
	Investment	0	42,000	42,000	42,000	42,000	42,000
	Depreciation	0	(2,100)	(4,200)	(6,300)	(8,400)	(8,400)
Total Fixed assets		0	39,900	37,800	35,700	33,600	33,600
Total Assets		160,000	119,365	79,609	62,693	76,324	76,324
Liabilities							
	Current Liabilities	0	679	1,281	679	1,922	1,922
	Long Term Loan	0					
Equity							
	Investment (O/E)	250,000	250,000	250,000	275,000	325,000	325,000
	Retained Earnings	(90,000)	(131,314)	(171,672)	(212,986)	(250,598)	(250,598)
Total Liabilities and Equity		160,000	119,365	79,609	62,693	76,324	76,324
ROI		-56.25%	-34.61%	-50.70%	-65.90%	-49.28%	-210.42%
Current Ratio			117.12	32.64	39.78	22.23	22.23

Balance Sheet:

	1995 1st Qtr	1995 2nd Qtr	1995 3rd Qtr	1995 4th Qtr	1995	1996	1997	1998	1999
Current Assets									
accounts receivable	4,000	2,400	3,000	4,200	4,200	30,050	48,625	67,400	115,875
Cash	40,375	79,628	48,231	95,466	95,466	115,940	188,427	303,088	596,362
Total Current assets	44,375	82,028	51,231	99,666	99,666	145,990	237,052	370,488	712,237
Fixed Assets									
Investment	42,000	42,000	42,000	42,000	42,000	55,500	69,000	69000	69000
Depreciation	(10,500)	(12,600)	(14,700)	(16,800)	(16,800)	(27,900)	(41,700)	(55,500)	(62,100)
Total Fixed assets	31,500	29,400	27,300	25,200	25,200	27,600	27,300	13,500	6,900
Total Assets	75,875	111,428	78,531	124,866	124,866	173,590	264,352	383,988	719,137
Liabilities									
Current Liabilities	3,393	2,562	2,771	4,484	4,484	22,735	36,618	49,953	84,061
Long Term Loan	0					0	0	0	0
Equity									
Investment (O/E)	350,000	425,000	425,000	500,000	500,000	575,000	625,000	625,000	625,000
Retained Earnings	(277,518)	(316,134)	(349,240)	(379,618)	(379,618)	(424,145)	(397,266)	(290,965)	10,076
Total Liabilities and Equity	75,875	111,428	78,531	124,866	124,866	173,590	264,352	383,988	719,137
ROI	-35.48%	-34.66%	-42.16%	-24.33%	-103.33%	-25.65%	10.17%	27.68%	49.25%
Current Ratio	13.08	32.02	18.49	22.23	22.23	6.42	6.47	7.42	8.47

Supporting information for financials

Transflux Developments company assets

	value ($)	1994	1995	1996	1997	1998	1999
Technical vehicle	20000	1	1	1	1	1	1
GM's vehicle	10000	1	1	1	1	1	1
Sales vehicle	7500			1	2	2	2
computers	6000	2	2	3	4	4	4
Total asset value		42000	42000	55500	69000	69000	69000

Depreciation (5 Years)

	1994	1995	1996	1997	1998	1999
Technical vehicle (20000)	4000	4000	4000	4000	4000	0
GM's vehicle (10000)	2000	2000	2000	2000	2000	0
Sales vehicle (7500 each)			1500	3000	3000	3000
computers (6000 each)	2400	2400	3600	4800	4800	3600
Total depreciation value ($)	8400	8400	11100	13800	13800	6600
Accumulated depreciation	8400	16800	27900	41700	55500	62100

Salaries

	1994	1995	1996	1997	1998	1999
Ross Walker	35000	35000	40000	40000	45000	45000
John Morris	30000	30000	33000	33000	36000	36000
Ian McInnis	50000	50000	55000	55000	60000	60000
Salesmen	0	0	22000	44000	44000	44000
Mechanical engineer		35000	37500	37500	40000	40000
Technician	0	0	0	33000	36000	36000
Dr Bodger	5000	5000	5000	5000	5000	5000
Dennis Breese	4000	4000	4000	4000	4000	4000
Total expenditure	124000	159000	196500	251500	270000	270000

BIBLIOGRAPHY

1. Chisolm, D. Developments of Heat Exchanger Technology - 1

2. Burton, B. & Jackson L. The New Zealand Boiler Stock 1982

3. Siegel, J. G. & Shim, J. K. Financial Management

4. Smith, F. C. Hot Water & Steam Supply By Electricity

5. Shields, C. D. Boilers Types, Characteristics & Functions

6. Williams, J. N. Steam Generation

7. The New Zealand Year Book 1993

8. ECNZ South Island Report 1992

9. Kotler, P. Marketing Management, Analysis, Planning, Implementation & Control